

100 THINGS THE SPACE SHUTTLE LAUNCHED

AIR & SPACE

Smithsonian

THE WILD BUNCH

10 BALLOONISTS
WHO DARED

**Monster Job:
B-36, Restored**

**HOMEBUILT
HELICOPTERS**

**The Stearman
Whisperer**

***My Mom Flew
Bombers***

PAGE 32

AUGUST 2010

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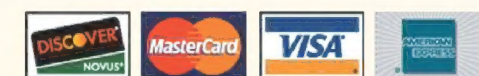
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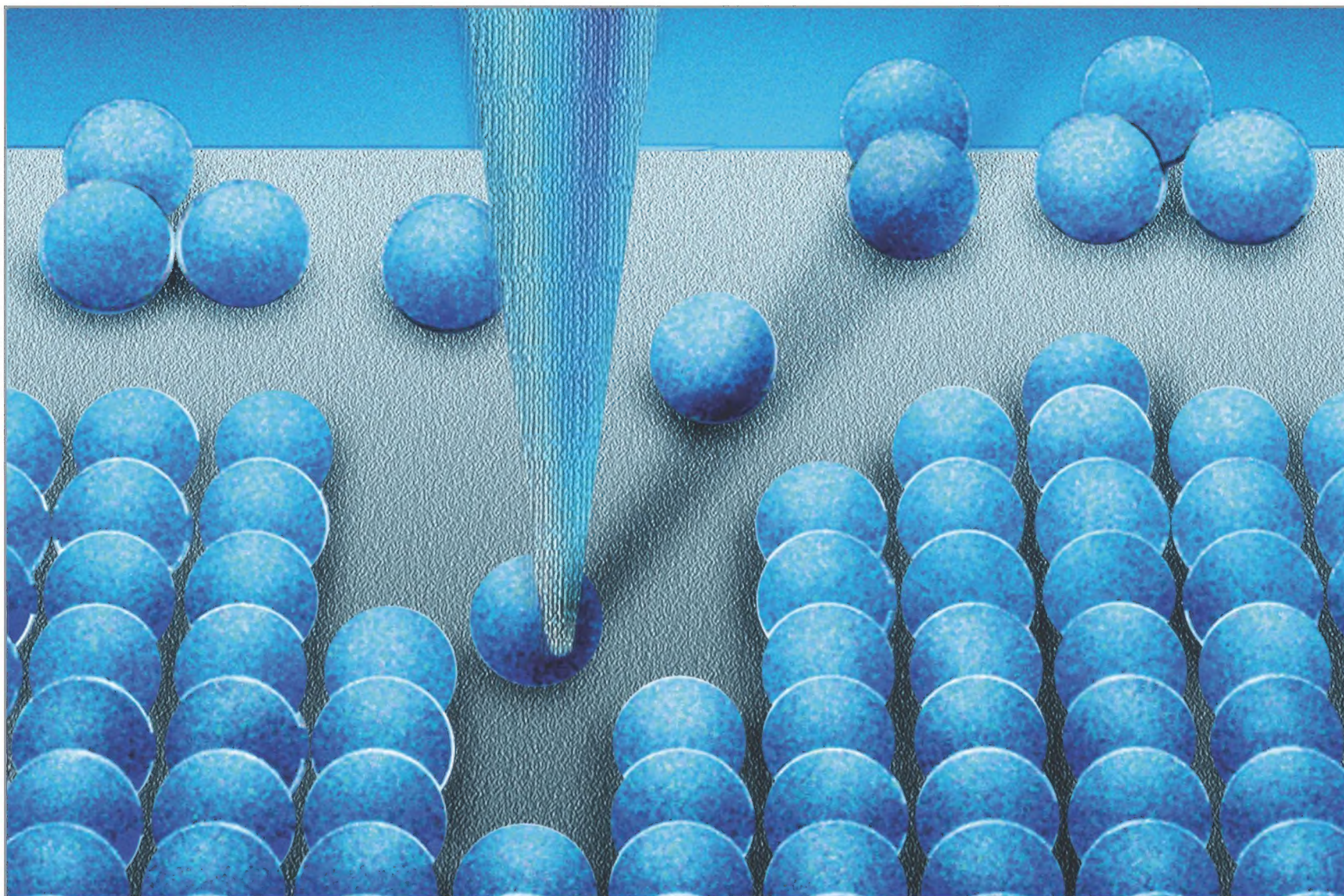
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ON THE COVER: From a Cessna 210, Jim Koepnick shot an exuberant Jonathan Trappe over North Carolina, dangling from what looks like a bunch of birthday balloons on a cluster flight, one of four he made before crossing the English Channel in May. Trappe's story and nine others, p. 24.



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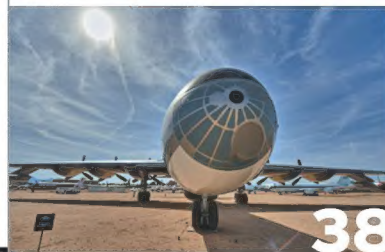
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Sharing the Wealth

AN ODD PAIR, the XB-42 and XB-43 bombers are excellent reminders that if you really want to understand aviation history, don't skip the footnotes. Unlike many of the aircraft that came to the Smithsonian Institution shortly after World War II, the two Douglas experimental bombers did not advance technology, mark a pinnacle of aeronautical achievement, or complete a historic mission. As a matter of fact, some have looked at the Douglas XB-42, with its oversize tail and counter-rotating propellers stuck on the back of the empennage, and wondered, "What were they thinking?"

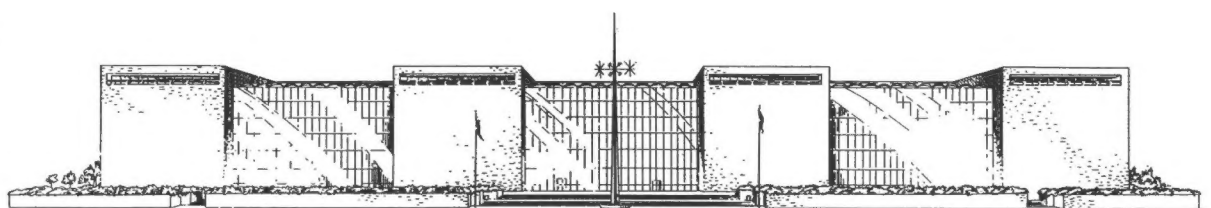
That's exactly what we at the National Air and Space Museum and curators at the National Museum of the U.S. Air Force in Dayton, Ohio, hope visitors will ask. And it's a question that the Air Force museum, where we recently transferred the two aircraft, is uniquely equipped to answer. That museum has assembled in a gallery, devoted to Air Force research and development, a host of exotic aircraft that were valiant attempts at solving tough engineering problems. Many of these were successful test aircraft, but others turned out to be impractical, unaffordable, or outdated by the time they were built. Either way, they teach us plenty about aviation.

Learning from the failed experiments or short-lived successes of aerospace is the basis for a new series in the magazine: "Cancelled." In this issue, the story of the McDonnell Douglas single-stage-to-orbit DC-X (page 66) shows that even failures can leave a legacy.

In the case of the XB-42, the Douglas engineers were searching in 1943 for a way to reduce drag so they could produce a bomber with greater speed and range than those already flying. To avoid the drag created by hanging big engines with whirling props on an airplane's wing, the engineers stuffed the engines inside the XB-42 fuselage and sent the props to the rear to keep from disturbing airflow over the wing. The result of this streamlining was a top speed of 410 mph, rivaling fighters of the era. But difficulty with the long shafts and complex gears connecting the engines to the props made the solution impractical, and the advent of the jet engine rendered it obsolete. Douglas later tried rudimentary jets on the XB-42 airframe, creating the XB-43. One XB-42, like the Convair B-36 (see page 38), had both jet and piston engines.

Although the XB-42 is an important footnote in aviation history—and its twin was the first U.S. jet-powered bomber—we at the Museum have come to realize that we don't have the room or the funds to restore and exhibit everything we consider significant. Our stewardship of the nation's air- and spacecraft collection has evolved, and we want to place more artifacts at other museums where they can be seen in an appropriate context. The National Museum of the U.S. Air Force is the perfect place for the XB-42 and -43. Some day, I hope to see them in the R&D Gallery there—and to read about them in the series "Cancelled."

■ ■ ■ J.R. DAILEY IS THE DIRECTOR OF THE NATIONAL AIR AND SPACE MUSEUM.



Letters

WRITE TO US



"Real" as in "Human"

"The Real Top Gun" (June/July 2010), does not mention that while practicing for a 2006 airshow at Davis-Monthan Air Force Base in Arizona, Dale Snodgrass landed an F-86 gear-up, and a wing fuel tank ignited. Captain Snodgrass is not perfect. It would be interesting to get his take on the mishap.

Frank Bushman
King George, Virginia

Debbie Gary replies: Though Snodgrass is a remarkable pilot, you're right: He is not perfect. In the first draft I submitted, I mentioned two incidents in which Snodgrass messed up and got into trouble. Only one made the final cut. If I were writing a long piece about him I would be sure to mention the gear-up landing and many other tidbits.

Connecting by Air

I was recently at a gathering of old Tailhookers in Virginia Beach, and we were passing around the June/July 2010 issue of *Air & Space*. Obviously we were all enjoying the article about Dale Snodgrass, as we all knew him and most had served with him. Although there is a little dispute as to whether he could have bested the legendary Joe "Hoser" Satrapa in a dogfight, Snort richly deserved all of

the accolades included in the article.

As I read other articles in the magazine I realized there was a very interesting tie-in among three of them. "The Last Gunslinger," on the F-15C, contained numerous quotes from Captain Ben Leestma. While Snort was the first "nugget" F-14 pilot (brand new, no fleet experience), David "Wizard" Leestma, Ben's father, was the first F-14 RIO (radar intercept officer) nugget. Then I read "Evolution of the Space Shuttle," which made me recall that Dave Leestma cut short what everyone believes would have been a fabulous Navy career to apply for the astronaut program; he was accepted in the 1970s. He flew on the shuttle as a mission specialist three times, conducting numerous spacewalks, and later spent many years as the chief astronaut. So apparently without realizing it, you had three articles in one issue tying together people and airplanes.

Lee "Beaner" Barthold
via e-mail

Bombing Takes Thinking

I was disappointed with a quote attributed to me in "The Last Gunslinger" (June/July 2010) that reads: "A guy that is going to drop a bomb has been given a discrete target. There is no decision making. In the F-15C, we're told to protect a

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IF YOU'VE BEEN VISITING the *Air & Space* Web site over the past month, you, along with more than half a million others, would have seen a time-lapse movie of the space shuttle *Discovery's* long journey to the launch pad. You could have seen close-up photographs of the legendary World War II **B-29 Enola Gay**, and snapshots of the South African air force's **Silver Falcons** aerobatic team. You could have seen aircraft in the **National Air and Space Museum** through the eyes of Museum photographer **Dane Penland**.

Don't let a day go by without checking the **Daily Planet blog** at airspacemag.com for news of aerospace events and commentaries on aviation and space history.



The Museum's Lockheed SR-71 set a speed record on its final flight: 64 minutes from L.A. to D.C.

DANE PENLAND

battlespace. It's a much more fluid environment.”

That was probably excerpted directly from my interview with the author, and in response to a direct question, but in the narrow context of the article, it appears as if I am saying that dropping a bomb takes no decision making. In fact, as a former multi-role instructor in the F/A-18, I understand how much decision-making goes into mission planning and execution with forward air controllers, intelligence specialists, rules of engagement, etc.

In large-force employment scenarios, however, the Eagle pilot is responsible for protecting multiple strike packages, as well as command and control aircraft. In my experience, this requires the F-15C pilot to maintain situational awareness of a much larger battlespace, compared with crews attacking discrete targets.

Lt. Col. Jim Stratton
Commander, 390th Fighter Squadron
U.S. Air Force
via e-mail

How to Taxi an Osprey

“Osprey at War” (Apr./May 2010) does not say how the aircraft taxis. The question occurred to me because when the Osprey is on the ground, the propellers are too large to be deployed in the forward flight position.

A.O. Merry
Pender Island, British Columbia

Lieutenant Colonel Ivan Thomas, Commanding Officer of Squadron VMM-261, replies: “In order to taxi the aircraft, we tilt the nacelles forward of vertical 10 to 15 degrees. That normally provides enough forward thrust to move the aircraft. We then steer the aircraft by using our foot pedals to turn the nose wheel. The nose wheel steering is hydraulically powered.”

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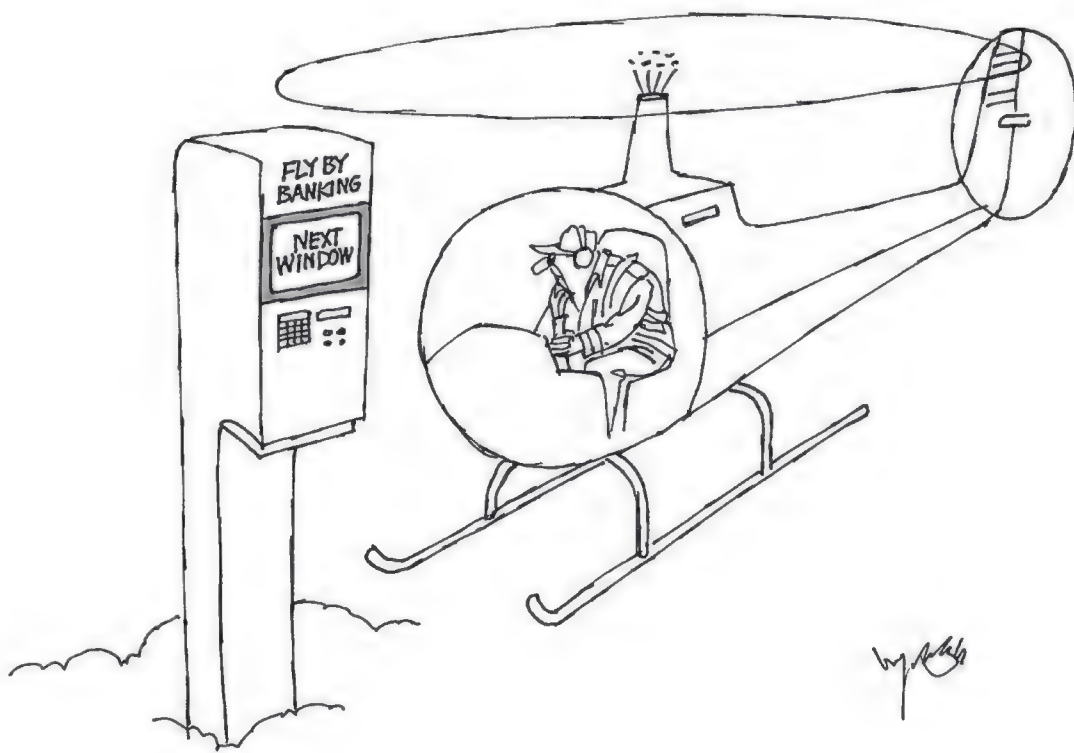
In “Don’t Cross That Line” (Feb./Mar. 2010), Craig Mellow quotes our wing



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Mr. James M. Kemper Jr.	



commander, Colonel (now Brigadier General) Joe Brandemuehl. First, Gen. Brandemuehl never spoke to the author of the article, though he would have very much liked to. Second, neither he nor any other commander would ever say, of the Canadian Cessna stolen last spring: “The F-16s improvised various stunts to get the pilot’s attention.” Nor would he refer to the aircraft as a “renegade.” When our F-16 pilots perform an intercept, they follow very strict procedures. The pilots on that intercept indeed dropped flares and flashed their lights at the pilot, but nothing about those procedures is improvised. Intercepting an aircraft is a delicate operation, and there is no room whatsoever for improvisation.

Lt. Col. Christopher J. Rodel
Public Affairs Officer,
115th Fighter Wing
Madison, Wisconsin

Editors’ reply: Gen. Brandemuehl is correct. Mellow was directed to Brandemuehl, but spoke with Lt. Col. Bruce Fisher instead, and paraphrased his remarks. The editors compounded the mistake by adding quotation marks around the paraphrased comments.

Bernard and Me

“The Pride of Cherry Grove” (Apr./May 2010) brought back one of my most cherished aviation memories. In the early 1970s, I had many encounters

with Bernard Pietenpol at his Cherry Grove, Minnesota hangar, and many talks with him about his Air Camper. Imagine my surprise when on one of the visits he offered me his Camper to take around the patch. I could not say yes fast enough.

We pulled the Corvair-powered Camper out. The preflight instructions were real simple: “Keep the rpm about 1900 and don’t let it get below 50.” Pietenpol handed me his leather helmet and propped the engine, and off I went. I remember the ground handling was different from what I was used to, and when I got to the end of the runway, I could not get the aircraft turned around. I got out (engine running), picked up the tail, pointed the plane down the runway, got back in, and took off. The takeoff, 10-minute flight around the patch, and landing were normal; the airplane flew beautifully. I remember thinking: How unreal, flying Pientepol’s own Air Camper, wearing his helmet, and flying from his own airport. It was

perhaps the biggest thrill of my professional aviation career (second only to getting my tail chewed out by Chuck Yeager, but that’s another story).

Edward Johnson
La Quinta, California

Stepping Out

“Honor Roll” (In the Museum, June/July 2010) tells the story of Oscar Mauterer and his Douglas A-1E Skyraider being shot down in 1966 over Laos. Oscar and I were together when checking out in the Skyraider at Hurlburt Field in Florida and later in the 602nd Fighter Squadron at Udorn Air Base in Thailand. He was a good guy! After he was hit he got out okay, but he didn’t eject, as your story says. Back then, the Skyraider had not been retrofitted with the Rocket Ejection Seat. It had a “single-step” egress—i.e., we stepped over the side.

Lewis S. Daugherty
Tucson, Arizona

Corrections

June/July 2010 “Interview: Raymond L. Puffer” (Soundings): Joe McConnell died on August 25, 1954, not January 1953.

“The Last Gunslinger”: Former chief Air Force engineer Frederick Rall is not deceased. We regret the error.

“Truck Killer”: The photograph on the top of page 30 shows pilot Tom Smith, not Jay Norton, and should have been credited “Courtesy Tom Smith.”

“Evolution of the Space Shuttle”: The space shuttle’s first orbital flight launched on April 12, not April 28, 1981.

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What Happens at Edwards... Pretty Much Stays at Edwards

BUD EVANS LAY down in the desert at California's Edwards Air Force Base, amid bottles and tin cans still littering an area near what's left of Pancho Barnes' resort. "This is pretty much what I remember seeing," he told the Air Force Flight Test Center Museum people. Then he took a picture.

Last April, Evans returned to the site where in 1959 he had been dragged by his parachute after activating the downward-ejection seat in a Lockheed F-104. He wrote about his wild ride in "The Unhappy Bottom Riding Club" in the February/March 2010 issue. Soon after publication, test center museum specialist Tony Moore e-mailed *Air & Space*. Moore is an X-Hunter, an aerospace archeologist who tracks down the crash sites of experimental aircraft. "I was reading 'Unhappy Bottom'



and realized I'd just been to Captain Evans' crash site on my birthday (I was looking for a site that was as old as I was)," he wrote. "I was using the old chimney at Pancho's as a landmark to search for the wreck, and was within sight of it when I found a wing panel piece with part of the 'stars and bars' on a background of fluorescent

orange high-viz paint."

In short order, Evans, who spent some seven years at Edwards, arrived for a trek out to retrieve the wing panel, although Moore had stored it away "to make sure it doesn't wander, so to speak," and brought it back out to the site for photos. One of the trekkers was flight test engineer Johnny

Bud Evans reunites with a piece of his F-104. Inset: Portrait of the pilot as a young man.

Armstrong, whom Evans knew from his years at Edwards, and who still works there. Another old friend was at the test center museum: the very same Piasecki H-21 helicopter that had retrieved him from the crash site 51 years ago. "The H-21 had been our test aircraft, and we kept it as our utility and rescue machine," says Evans. (The Flying Banana awaits restoration.)

Before leaving the impact crater the F-104 had made, Evans asked Moore, "You know what the best thing about this is, Tony?"

"No, sir, what's that?"

Evans pointed at the crater. "I'm not in there."

PATRICIA TRENNER

UPDATE

Beware of Rotorwash

BOEING HAS ANNOUNCED it will enter its V-22 tiltrotor in the competition to replace the presidential fleet of Sikorsky VH-3D Sea King helicopters ("Osprey at War," Apr./May 2010), as well as its CH-47 Chinook, and, under license from Finmeccanica, the AgustaWestland AW101. The *Washington Post's* Al Kamen reported on May 12 that Winslow Wheeler of the Center for Defense Information said that the Osprey, "when landing, will unleash high-speed sod clumps in all directions [and] will have the added – much to be desired – effect of scattering the White House press corps." This was aptly demonstrated at a Staten Island park on Memorial Day, when a descending Marine Corps MV-22 tore branches from trees and stirred up mini-tornadoes of dirt and debris, causing minor injuries to 10 onlookers. "We came in over the trees," said a crew member. "The next thing we see is a [picnic] blanket coming up in the air."

How Are Airships Like Boomerangs? They Just Keep Coming Back

IN THE NEXT few months, E-Green Technologies, based in Kellyton, Alabama, hopes to launch the world's largest operational airship. The outer envelope of the 235-foot-long, 65-foot-diameter Bullet 580 is a new type of Kevlar (a prime component of bulletproof vests), which designers hope will make the craft light enough to soar past 20,000 feet and carry up to 2,000 pounds of payload or 19 passengers. The \$8 million airship will get its lift from a system of helium-containing bags.

The largest airships ever made, *Hindenburg* and *Graf Zeppelin II*, were just over 800

feet long and 135 feet in diameter. Lockheed Martin last year built and inflated a 240-foot-long, 70-foot-diameter prototype called HALE-D, but that craft ran out of funding before it could fly.

In an inflation test in May, a prototype Bullet 580 nearly filled the Garrett Coliseum in Montgomery, Alabama, near the factory where the airship will be produced. E-Green touted 580's uses as surveillance platforms, communications "stratellites," leisure cruisers, and advertising vehicles (the company is also working on spherical designs—the SA



THE SHUTTLES RETIRE

Last Call for a LEGO Shuttle

IT'S NOT LIKE LEGO never put out a space shuttle before. The 1996 LEGO Technic 8480 fiber optic model (1,366 pieces, \$158) was a hit, as was the 2003 Discovery 7470, which commemorated the deployment of the Hubble Space Telescope (826



The U.S. human spaceflight program, in pieces.

pieces, \$380 including telescope). But the brand-new Shuttle Adventure (1,204 pieces) seems like a bargain at a mere \$100. It includes two astronauts and a service crew member and can separate from the launch pad; the external tank and solid rocket boosters also separate. Deploy the satellite and unfurl the antenna and solar cell panels. Then disassemble it, put the pieces back in the box, and sell the kit on eBay in 2030.

60 Soccer Ball Airship recently flew—for sporting events).

The Bullet 580 will use propellers (turned by engines running on algae-based biodiesel) vectorable to direct thrust in any direction, so the ship can hover and descend to a pinpoint landing or cruise at 80 mph.

E-Green test pilot Allan Judd likens piloting the ship more to operating a boat in an ocean of air. "It's really not flight," he says. "It's flotation and buoyancy." The company hopes the romance of lighter-than-air flight will attract customers

E-Green Technologies pushes the envelope of its Bullet 580 airship.

to its next planned airship, capable of carrying 75 passengers.

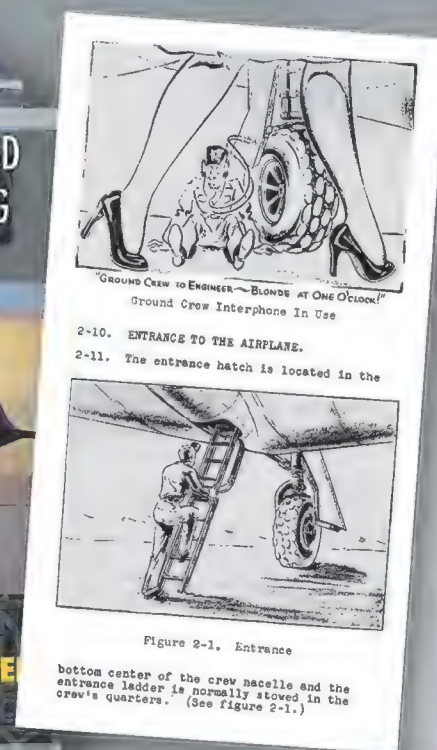
But first, the Bullet 580 will have to prove itself in flight tests at Florida's Kennedy Space Center or California's Moffett Field. The first flight will carry an experiment package for NASA and Virginia's Old Dominion University designed to measure the moisture content of the soil below from a vantage point of up to 20,000 feet.

MICHAEL BELFIORE

Esoterica

"WANT TO KNOW HOW to ditch a B-29?" asks Nick Sparks, a partner in Periscope Film LLC in Los Angeles. "Or how to eject from a B-47? Or prepare to land the X-15?" Sparks' company, which has produced a documentary about Regulus missile submarines, sells flight manuals for dozens of military aircraft, from V-1 Buzz Bomb Manual to MiG-29 Fulcrum Pilot's Flight Operating Manual.

The first manual Sparks acquired, which he used to show to guests, was for the YB-49 Flying Wing: "Who knew that the Air Force used cartoons featuring beautiful damsels to train crews to fly a nuclear bomber?" Though most of the manuals were long ago declassified, he has at times invoked the Freedom of Information Act, as he did to obtain the manual for the XB-70. His best seller? The P-51 Mustang Pilot's Flight Operating Manual at \$16.95. Visit periscopefilm.com.



Cartoons helped lighten the leaden text in some military aircraft manuals.

Betting on the Mars Man Cave

ON PAPER, YUE WANG looks like the perfect recruit for an experiment in long-term space living. Astronaut trainer, 27 years old, medical degree. No wonder he was picked for Mars 500, a Russian-led simulation in which six volunteers—all men—will live in a chamber in Moscow for 17 months, pretending to be on a round-trip mission to the Red Planet.

And yet, at the moment he's the early favorite to start banging on the hatch, demanding to be let out before his 520 days are up. Something about Wang we don't know? Not really, says Ken Robertson, communications manager for the Irish bookmaker Paddy Power, which is taking bets on the Mars 500 crew members' chances of sticking out the longest space mission simulation ever conducted. It's just that as a Chinese, Wang will be the most culturally isolated of the volunteers, three of whom are Russian and two of whom are European. So Paddy Power's handicappers set his

initial odds of quitting early at 2:1.

Diego Urbina, a 27-year-old Italian who has already done a shorter Mars simulation in Utah, started the Moscow sim at 5:2, slightly more likely to give up than 31-year-old French engineer Romain Charles (7:2). Russians Alexander Smoleevskiy (5:1), Sukhrob Kamolov (8:1), and Alexey Sitev (10:1) have decent odds of hanging in to the spirit-crushing end.

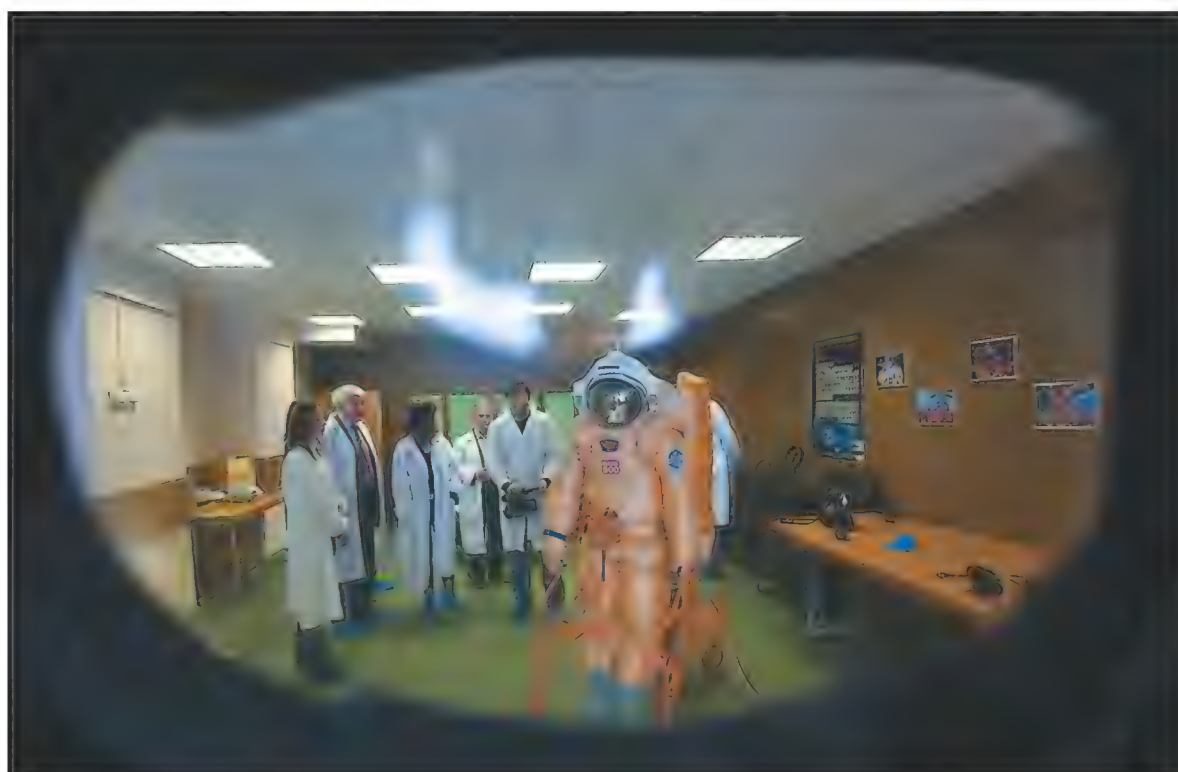
There are few wagers the bookmaker won't take in the "novelty bets"

category. Will the head of BP resign? What actor will be the next James Bond? Which celebrity will get pregnant next? (Beyoncé is 6:1; Lady Gaga, 33:1.)

For those who prefer something weightier, Paddy Power has a bet on the real space program. Starting odds have the Americans as 11:10 favorites to be the first nationality to walk on Mars, followed by the Chinese (7:4) and the Russians (5:2). The Irish are 500 to 1.

TONY REICHHARDT

Greetings, fellow chamber-naut: a view from an Orlan spacesuit helmet.



Story Musgrave

FORMER SPACE SHUTTLE ASTRONAUT

A veteran of six shuttle flights, Musgrave, who flew on all five orbiters, has seven degrees, including a doctorate in medicine. During his 30 years with NASA, he worked as a part-time trauma surgeon. As a pilot, Musgrave has logged 18,000 hours in 160 types of aircraft. He is the author of *The NASA Northrop T-38: Photographic Art from an Astronaut Pilot* (see p. 71).

You've flown six shuttle missions. Did being in orbit ever start to feel routine?

No. You cannot get enough of Mother Earth, and the heavens too: the stars, the aurora, and shooting stars. You can't get enough of playing in an environment you were not evolved to be in. It's the art of the mission – how smooth you can pull it off one day after

another. Not in a compulsive way. But it got better every flight. I got better too.

In what way?

What I could get done up there. I flew in my 40s, 50s, 60s. I was also a communicator at mission control for 25 missions. I understood that world. I flew with 27 different astronauts, with 17 rookies. Spaceflight is not reflexive – it's not kick the tires and light fires. It's a very complicated, artistic business. You have to like the space business, not just the flying.

How do you feel about the retirement of the space shuttle program?

I have purely personal affection for it. I never wanted to do that particular machine in the early '70s – I thought it was the wrong idea. But American engineering pulled it off, and it did what it did magnificently. A lot of new technologies, new science, and new ways of doing things in space,

but at massive cost, fragility, and vulnerability. It's had an awful long run. And everything has its timing. The timing now is strange, when you're doing away with the only way to get to the space station. It really is time to move on to the next one. But it turns out we're moving on to nothing.

How do you feel about the Obama administration's cancellation of the Ares/Constellation program?

The entire future of space policy – it's dead. It's nothing. We need access to space in the year 2010, because the shuttle is going away. We need access this year, so what is the response? We're going to think about it for five years, and then make a decision. Which means we're 15 years to getting access to space. That is not my kind of space program.

Who impresses you?

Lots of people – von Braun was one. He read science fiction. His vision was unbelievably large. From a teenager on, he was loyal to spaceflight. He pursued it through the doctorate in physics. The story of him and 118 Germans coming to this country in '45, and the fact that our moon program rested on that man's shoulders. He was a charismatic communicator, and presence. If you were within a hundred yards of him, you felt him.

Any aircraft that you wanted to fly but didn't?

The SR-71. I didn't have a relationship with it, but gee whiz. It's just such an advanced animal – decades ahead of its time.

What kind of cars do you drive?

Of course I have a Corvette. I like the '94 Corvette because it's so simple. I had a '58 Corvette – that is a classic.



Musgrave – and the space shuttle – both worked for NASA for 30 years. Above: Musgrave, on Endeavour's robotic arm, services the Hubble Space Telescope.



Read the entire interview at airspacemag.com.

Sightings

PICTURES WORTH A SECOND LOOK



"YOU CAN LIKEN the scenario to skipping a stone on water, or a barefoot water skier," says South African photographer Frans Dely. "The water compresses and becomes as solid as concrete." This is how Scully Levin, one of South Africa's top aerobatic and show pilots, makes his AT-6 Harvard walk on water. Levin was at the controls of the lead airplane of the Flying Lions (above) on a lake northwest of Johannesburg in February 2006.

Some years prior, a friend of Levin's who was famous for tall tales was telling one around the campfire about seeing a pilot water ski an airplane





on its tires. The other campers advised their friend to find a more gullible audience. But Levin pulled the storyteller aside and quietly peppered him with questions. The next day, Levin mastered the trick in his Super Cub.

For the 2006 shoot, Dely, in the back seat of the team's fifth airplane, got a straight-down shot (opposite, top). Last winter he flew in Levin's back seat in the Left Hand Finger Four lineup, like that shown above. Dely photographed the airplane in the slot off the left wing, flown by team owner Arnie Meneghelli (opposite, bottom). On the

water, the team maintained a speed somewhere between 90 and 100 mph. The pilots were forced to apply a bit of forward stick pressure at the water's surface, and the tires began hydroplaning when they had sunk in about four millimeters. "As with any air-to-air shoot, a detailed briefing is key to success," says Dely. "When the pilots involved understand exactly what is expected of them, you can begin to push the envelope while keeping it safe. I often say, 'If you can fly it, I can shoot it,' but I'm always mindful of the fact that it is a team effort."

In the Museum

STOPS ON A TOUR THROUGH AMERICA'S HANGAR

Life Among the Savidges

NO MATTER HOW MUCH a curator knows about his or her subject, you never know when you are going to learn something new. I specialize in the history of early aviation, but that was the last thing on my mind as I pedaled my bike into Ewing, Nebraska (pop. 405), around 2 p.m. on September 7, 2009.

A friend and I had set out from Deadwood, South Dakota, five days before, headed south through the Black Hills on the Mickelson Trail. Now we were riding east across northern Nebraska on the Cowboy Trail. When I pulled into Ewing, my buddy's wife Bonnie, who was shadowing us in a van, pointed out a large mural on the side of a building. It was a painting of an early Curtiss-type

Descendants of the Savidge brothers gather in front of a Main Street mural commissioned by the residents of Ewing.



John, Joe, George, and Matt Savidge (from left) with one of their biplanes, ca. 1912. Legend has it that Barney, a one-eyed barn cat, served as test pilot on the scaled-down version. In January 2009, the brothers were inducted into the Nebraska Aviation Hall of Fame.

pusher biplane. I rode over for a closer look and was surprised to discover that the building, the town library, was open on Labor Day. I went in and introduced myself to the librarian, Idella Tuttle, who explained that she had an appointment the next day, and had spread the word among the townsfolk that the library would be open on Labor Day instead.

On top of the library shelves I spotted some framed photographs of the old pusher airplane, and while I inspected them, Tuttle called Jerry Tomjack, the local aeronautical historian. He arrived in his pickup three minutes later, and charged through the door expressing doubt that a Smithsonian curator had actually found his way to Ewing. "You people just don't come to small-town America," he said. I assured him that in this case, one of "us people" had actually bicycled into this small town.

The airplane depicted in the mural, Tomjack explained, had been built by the seven Savidge brothers—George,

John, Joe, Dave, Matt, Phillip, and Louis. The brothers grew up at the turn of the century just south of town, and had a reputation for equipping the family farm with all sorts of ingenious inventions. They launched their flying machine experiments with small gliders, enlisting the farm cats as test subjects, then moved on to larger machines that they rolled down the barn roof and into the air with a brother aboard. With that experience, they set to work on a powered machine based on the classic early biplanes of Glenn Curtiss. The pilot sat on a seat salvaged from a mowing machine. The frame was constructed of wood and metal tubing, while the wings were covered with shellacked muslin. They purchased the engine, propeller, and wheels from an aeronautical supply house, after consulting, one local historian believes, with the knowledgeable staff of Ewing's own Spittler Brothers Hardware.

They made their first public flight from a nearby field on May 7, 1911.



Buggies, wagons, and even the occasional horseless carriage conveyed a growing number of spectators to the Savidge place. It was the beginning of a five-year period during which the brothers made occasional flights in other parts of the west. Back in Ewing on June 17, 1916, Matt, regarded as the most daring of the boys, took up a new airplane and crashed to his death. It was the end of the Savidge brothers' aeronautical career.

We would be heading back through town early the next morning, and Jerry promised to tape an envelope with additional information about the Savidges to the monument that the town had erected in their memory just off the main street. When we pulled up, there was Jerry, envelope in hand. He wanted to give it to me himself.

When I returned to the Museum the following week, I immediately checked our archive, only to discover we had no file on the Nebraska brothers. Nor were they mentioned in the very thorough aeronautical American Early Birds



Star Party Join Museum astronomer Sean O'Brien on Saturday, August 14, from 8 to 11 p.m., in observing celestial objects in skies unpoluted by city lights. Sky Meadows State Park, Virginia. Parking fee: \$4 per car. Park phone: (540) 592-3556.



What's Up Receive regular updates on Museum events, read about artifacts, get detailed (and behind-the-scenes) exhibition information, and receive calendar listings, all by subscribing to the National Air and Space Museum's free monthly newsletter, *What's Up*. Sign up at nasm.si.edu.



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division files, compiled many years ago on those who flew before 1915. Thanks to Jerry Tomjack and Idella Tuttle, that situation has been corrected. The

National Air and Space Museum came to Ewing, Nebraska, after all, and learned something in the process.

 TOM CROUCH

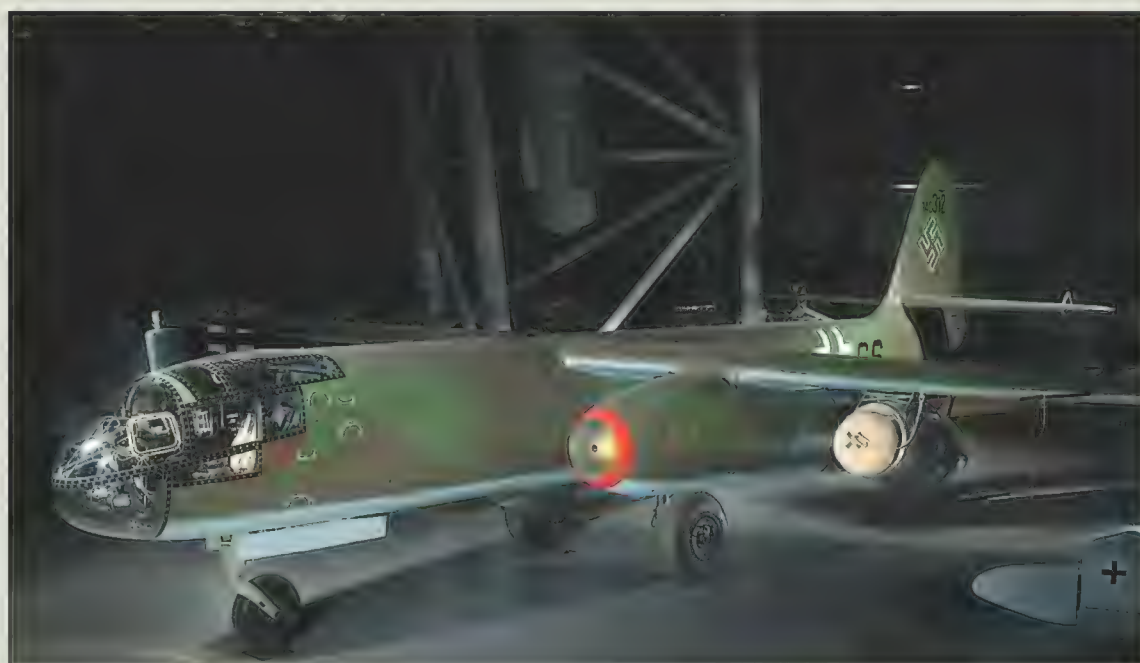
ARTIFACTS

Air Blitz

WITH A TOP SPEED OF 456 MPH, the German Arado Ar 234 B Blitz – the world's first operational jet bomber and reconnaissance aircraft – was far faster than any piston-engine Allied interceptor in World War II.

The Ar 234 arrived at the war late; although the airframe was ready in 1942, most available flight-ready engines went to Messerschmitt Me 262s, so the Ar 234 didn't enter service until 1944. Even though there were relatively few Ar 234s made, they provided the Luftwaffe with excellent reconnaissance information.

The Museum's Ar 234 – along with three others – was shipped to the United States in July 1945 by the U.S. Army Air Forces. It was transferred to



the Smithsonian Institution in 1949. Its restoration began in 1984 and was completed in 1989; the aircraft's markings are typical of the Eighth Squadron, Bomber Wing 76, the first bomber unit to fly the Blitz.

The Museum's Steven F. Udvar-Hazy Center in northern Virginia displays the world's sole surviving Arado Ar 234 bomber, one of nine that the Germans surrendered to British forces at the end of World War II.

Cornwell's Folly

THE WIND KICKED GRAVEL

against the pitted windows in the town post office, where I had gone to find out if I'd gotten in to graduate school at the University of Colorado. I didn't think the letter had arrived, but with time on my hands I was looking for something—anything—to do, so I drove into town to check.

When I first went away to college, I used to come back home to Deer Trail, Colorado, frequently, plus I worked summers on the farm, so I kept up with who was there and what everyone was doing. But I had been away too long. I didn't have much to talk about with the people who remained. After a couple of weeks sitting around, with nobody to see and nothing to do, I was bored stupid.

"Whatcha doin' here, Squee?" It was John, a local cowboy.

"Oh, nothing, John," I said, "just looking for some mail."

"So whatcha been up to?"

"Not a hell of a lot of anything," I replied. "I'm a fish out of water, John."

"Let's go for a ride."

We stopped at a liquor store, where John picked up a case of beer, and drove eastward, in the general direction of Kansas. After nearly an hour, I was beginning to get an inkling of what the plan was. When we passed through the boundary of federal land referred to as The Breaks, I knew the destination. In another 15 minutes, sure enough, I saw that the wreck was still there.

Torn, weathered, Army-surplus canvas flapped from the starboard wing. The landing gear—converted Model A spoke wheels—sat rusting in the Colorado desert. Sun-baked tires, long

flat, clung to the rims, submerged in drifted sand. The cockpit windows were broken, probably shot out by some youthful hunter, or shattered by hail. The fuselage and tail section were in good condition, but years of prairie winds had left both warped and twisted.

While under construction, this aircraft was the laughingstock of the county. Only Ed Cornwell thought it would fly.

John and I had enjoyed a few quiet moments sipping our beer and appraising the discarded vehicle, framed in buffalo grass, with the Rocky Mountains as backdrop. As I watched, the old relic seemed to come alive. In fact, John and I were there together when Ed's big day had come around.

"Ready for another beer?" John asked.

"Sure."

John reached in the back seat of his Chevy convertible, and my thoughts drifted back to a September morning in 1948. This might take more than one more beer, I figured.

I happened into Ralph Lessy's welding shop one afternoon. Ralph was designing something for a huge engine

A half-baked excuse for an airplane, cobbled together in 1948, spent its entire life eroding in a Colorado desert.

that sat on the concrete floor. Ralph, a laconic grouch to those who didn't know him, was actually funny, clever, and somewhat acerbic. He was an expert and creative welder, and if he liked you, he would make anything for you, even if he considered it a waste of his time. He tolerated Ed Cornwell and knew that what he was putting together for Ed didn't make much sense.

"What are you building?" I asked.

"An engine mount for Ed Cornwell's airplane," he said.

I looked at the six-cylinder behemoth sitting nearby on the concrete floor.

"That's a truck motor," I said.

"I can tell you're gonna go far, kid," said Ralph.

"Well, Ed was an aviator in the war. He must know what he's doing."

Ralph reached for his welding hood. "A lot of folks thought he was, but he loaded bombs."

"He was a pilot, Ralph! Everybody knows that!"



“He was in North Africa with Doolittle. I was in North Africa with Patton. I know what Ed Cornwell did during the war.”

Ralph pulled his helmet down—my cue to leave.

John Dugan, who knew everything about wood, ran the lumber yard. He was a dour old guy, but tolerant. I played baseball with his kid, Tommy, who had a big butt and could hit a half a mile. I found out from Tommy that his dad was helping Cornwell with his airplane. I had to get in on that.

We stood under the overhang, watching the construction. Old John and Ed were gluing the wing spars. It was a big operation.

“Where’s the propeller?” I asked.

Ed, a muscular blond who looked like Joe Palooka, glowered at me. “That’s none of your affair, Squee,” he snapped. Apparently he took me for one of his skeptics.

“Okay. I was just asking.”

Old John explained. “Ed’s whittling it out himself.”

“Out of what?” I asked.

“Hickory, goddammit!” Ed snarled.

“You and Tommy be on your way!”

I knew Sherman Quine, a handsome dark-haired guy who had married my elementary school teacher and had made bomb runs over Germany in B-24s. I walked up to the porch of his sumptuous red brick home to find out what he knew about Cornwell’s airplane. The Colonel—that’s what we called him—hadn’t been in the war for God, country, and glory; the man was there to fight and win, so he could come back and get his farm equipment dealership established. He was an easygoing gentleman, receptive to questions.

“Did you know Ed Cornwell’s building an airplane?” I asked.

“Yes,” he said, nodding.

“I just saw it,” I said. “It looks pretty raw. Doesn’t he need controls, plexiglass, hydraulics, and things like that?”

“He does,” Quine said.

“Where would he get that stuff?” I asked.

“I arranged for it.” The Colonel’s voice had a tone of resignation.

“Where? How?”

“Out of a salvaged L-19.”

“What’s that?”

“A spotter plane. Something like what he’s trying to put together,” Quine explained.

“I’ve always heard he was a pilot,” I said. “Ralph Lessy says he isn’t.”

“No, he’s not.”

“He’ll kill himself!” I said.

“I wouldn’t think so,” the Colonel replied.

“Why not?”

“He won’t get off the ground.”

To Ed’s credit, he picked the right spot for the attempt. The public land was grassy, smooth, and infinite. The day of the flight, all types came from miles around—ranchers, townspeople, farmers. John Arness, who owned the newspaper, was there to record the big event. Cars ringed the area, and they honked

Ed crawled into his contrivance and closed the door. All horn honking and conversation ceased.

Minutes passed, and it began to look like Ed may have caved in to his detractors. Then the propeller began to turn. Car horns began anew. The engine caught, and the propeller became a blur—spinning hard, noisy, and certain. In an instant, the mood changed. The audience began rooting for the all-American buffoon to pull it off.

The engine roared, the airplane shook, and the propeller strained. Ed had the power at maximum, but after a few long, precious seconds, the airscrew could no longer stand the stress. The propeller broke, both halves flying like missiles. Years later, a wrangler discovered a broken propeller section far away in a gully.

Cornwell cut the power, and the engine wound down in a humiliating whine.

A few had wanted to see the airplane take off, and others had divined its failure. No one moved. The Colonel, realizing Cornwell was not about to exit

TORN, WEATHERED, ARMY-SURPLUS CANVAS FLAPPED FROM THE STARBOARD WING. THE LANDING GEAR – CONVERTED MODEL A SPOKE WHEELS – SAT RUSTING IN THE COLORADO DESERT. SUN-BAKED TIRES, LONG FLAT, CLUNG TO THE RIMS, SUBMERGED IN DRIFTED SAND. THE COCKPIT WINDOWS WERE BROKEN, PROBABLY SHOT OUT BY SOME YOUTHFUL HUNTER, OR SHATTERED BY HAIL.

incessantly. Some spectators set up tables with lemonade; others with booze. The crowd clamored. Tufted, puffy cumulus clouds drifted in a clear sky.

Ed strutted to the aircraft and directed his crew away. He didn’t acknowledge the crowd, and if that was on purpose, no one could blame him. That group would not have given him a chance.

The airplane, in its military olive drab, was ready. It did, in fact, look airworthy.

his airplane to face the silent audience, ushered them away.

I contemplated the deteriorating wreck, and after I had finished a more than adequate amount of beer, I thanked John. “I needed that,” I said.

We drove away. Ed’s old airplane had struggled mightily to indulge its maker. But it wasn’t a total failure: It brought me home.

 LEWIS A. BARTLETT

How to Degauss a Cat

THE IDEA CAME TO ME after I read a magazine article describing how an aircraft can become magnetized simply by flying through Earth's magnetic field or when electrical currents flow through an aircraft's structure. It can then generate its own magnetic field(s), which may confuse a compass, radio and navigation aids, and other instruments. Magnetic fields could affect not only light aircraft but also rockets and astronauts. Surely we wouldn't want our rockets or astronauts to be wandering around space without accurate instruments for navigation and control.

The process of eliminating magnetic fields from an object is known as degaussing. We tested the effects of outer space on dogs and monkeys, so how about testing the effectiveness of degaussing on animals that are sensitive to such things?

Cats are ideal for this purpose. Note when a cat is lying in a certain orientation. Pick it up and then put it back down. If it chooses the same orientation (to magnetic fields), then it is in need of degaussing.

The procedure, which is best conducted before placing the cat inside the capsule or rocket or other confined space, is as follows.

First: Take the cat outside and coil a lightweight copper or aluminum wire loosely around it, beginning at whichever end the cat prefers, or allows. The coil may be either right-handed or left-handed, but be sure to note the direction of the coil and whether the cat is left-pawed or right-pawed, so the outcome may be correlated later.

Second: Wrap either end of the wire around a long nail and drive the nail



No cats were successfully or unsuccessfully degaussed for this article.

into the ground. Note which end of the wire is used.

Third: After a suitable period of time, remove the wire from around the cat, or remove the cat from within the wire. Cats generally choose the suitable time period, and will pretty much take it from there.

Finally: Check to see if the cat's direction is more random when lying down. If so, then the procedure has been successful. If the cat still appears to be polarized and unduly oriented within the magnetic fields, then a repeat of the procedure is recommended.

If the cat does not respond to the above, then "self-degaussing," in which the cat frees itself from the magnetic fields, may be worth a try. This procedure is also best conducted outdoors, as will be obvious later.

The cat is caused to lie on its side, or better, is found lying on its side of its own accord. An eyedropper is used to place two or three drops of three-percent hydrogen peroxide into whichever ear is facing the dropper. At this step, it is important not to try to restrain the cat, lest one become subject to the various contaminants the cat sheds as it leaves magnetic fields behind and joins the squirrels in the trees. Here one may notice how gracefully the cat leaps from tree to tree, once freed from the bonds of polarization, magnetic fields, and other inconveniences.

After trying this method, note how the cat no longer appears entrapped by magnetic fields, as evidenced by the cat changing direction whenever you enter the room, and going elsewhere at a high rate of speed.

■ ■ ■ G. CURTIS HOSKINS

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That's what my doctor recommended. He said, "Gravity Defyer shoes are pain-relieving shoes." He promised they would change my life --like they were a fountain of youth. "They ease the force of gravity, relieving stress on your heels, ankles, knees and back. They boost your energy by propelling you forward." The longer he talked, the

more sense it made. He was even wearing a pair himself!

So I did my research

I read all the articles from Doctors like Dr. Mark Vinick (Board Certified, American Academy for Pain Management, Anti-Aging Health and Ayurvedic medicine), and Dr. Selim El-Attrache (American academy for orthopedic and disability evaluation and rehabilitation). I carefully reviewed the extensive 54 page study and analysis by Packer Engineering. I learned how the Gravity Defyer's VersoShock™ Trampoline Technology absorbs impact, eliminates pain and propels you forward, to reduce fatigue and make you more active. With Gravity Defyer I could burn more calories and sculpt my body painlessly! I could be filled with energy! It all made sense. No more coffee or energy drinks for me!

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WOMEN (Silver with Navy)

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The TRUCK

**SATELLITES, EXPERIMENTS, SPACE STATION PARTS –
THE SPACE SHUTTLE HAULED IT ALL. BY PAUL HOVERSTEN**

THE SHUTTLE was the king of multi-tasking. On its final missions this year, it will continue its work as a people mover and space station supplier, but over its career, the shuttle was a heavy lifter, carrying more than 100 primary payloads to orbit. Its cargo bay—60 feet long, 15 feet wide—was built to satisfy the National Reconnaissance Office, which wanted to make sure its biggest satellites could go. Though the bay could carry up to 54,000 pounds, no payload hit that number (the closest: a 46,500-pound NASA Tracking and Data Relay Satellite launched in September 1988). Its greatest strength was versatility: Only the shuttle could put something in orbit, then go get it and bring it back.

The space shuttle's cargo bay is more than just a shipping container. It's also a workspace for spacewalkers.

SHUTTLE PRIMARY PAYLOADS • Aerodynamic Coefficient Identification Package • Office of Space and Terrestrial Applications Experiment • Plant Lignification Experiment • Electrophoresis Verification Test • Monodisperse Latex Reactor • German Shuttle Pallet Satellite • INSAT • Spacelab • Westar • Palapa-B

• Magnum Satellite (DOD) •

Long-Duration Exposure Facility

• Satellite Business Systems

• Earth Radiation Budget Satellite

• Telesat • Telstar 3 • Arabsat

• American Satellite Company

• AUSSAT • Morelos •

Satcom Ku • Defense Satellite

Communications System (DOD) • Tracking and Data Relay Satellites • Lacrosse 1 Reconnaissance

Satellite (DOD) • **Magellan** • Satellite Data System (DOD) • Galileo • Magnum Reconnaissance

Satellite (DOD) • Syncom IV • Misty Reconnaissance Satellite (DOD) • **Hubble Space**

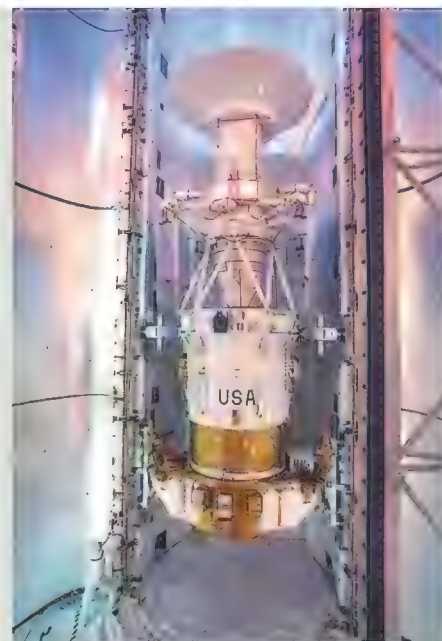
Telescope • Ulysses • Ultraviolet Astronomy Telescope • Compton Gamma-Ray Observatory

Science Projects

The pressurized module Spacelab, which flew two dozen times in the 1980s and 1990s, turned the shuttle's cargo bay into a round-the-clock lab, with astronauts on 12-hour shifts (a similar commercial module, SPACEHAB, flew almost as many times). In April 1984, a crew deployed the school-bus-size Long Duration Exposure Facility with 57 experiments; it was retrieved in January 1990. One hard-luck case was the Italian-built Tethered Satellite System. In August 1992, the tether jammed. Reflown in February 1996, the tether stretched to just shy of the planned 12.5 miles before it broke and the satellite was lost.

Tourists to Other Worlds

In quick succession, the shuttle sent three interplanetary probes on their way from the cargo bay within an 18-month period in 1989 and 1990. Magellan, a radar mapper bound for Venus, was launched in May 1989. That October, a shuttle started Galileo on its voyage to Jupiter. Both probes used Boeing-built Inertial Upper Stages to get to their destinations. The following October, Ulysses, a probe jointly run by NASA and the European Space Agency, left the shuttle cargo bay with two upper stages—an IUS and a Payload Assist Module—to boost it into orbit around the sun. The Jet Propulsion Laboratory in Pasadena, California, had built all three interplanetary explorers to the cargo bay's dimensions.



A technician (left) readies Magellan before launch. Its Venus mapping mission lasted five and a half years.



The Tethered Satellite was to study effects of electromagnetic forces on the tether, satellite, and shuttle.

• Infrared Background Signature Survey • Upper Atmosphere Research Satellite • Defense Support Program Satellite • International Microgravity Laboratory • Atmospheric Laboratory for Applications and Science • U.S. Microgravity

Home Away From Home

Last in a long line of payloads: pieces of the International Space Station. The first U.S. component, a connecting module called Unity, was launched in December 1998. The shuttle crew joined it with the Russian power module Zarya, which had launched a month earlier on a Proton rocket from Kazakhstan. Since then, nearly every shuttle flight has carried station parts. The largest shuttle payloads delivered to the station were the four solar array-truss structures that flew in November 2000, September 2006, June 2007, and March 2009. By the time the shuttle program ends, orbiters will have flown 36 times to the ISS. The station now has a pressurized volume equal to that of a six-bedroom house.

As its final act, the shuttle was at last able to fly the mission that NASA in 1972 invented it for: building and supplying an orbiting space station.



Laboratory • **Tethered Satellite System** • Laser Geodynamic Satellite • Advanced Communications Technology Satellite • Wake Shield Facility • Space Radar Laboratory • Lidar In-Space Technology Experiment • KidSat • Shuttle Pointed Research Tool for Astronomy • Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere • Neurolab • Chandra X-Ray Observatory • Shuttle Radar Topography Mission • Space Experiment Module 8 • **Space Station**



Most payloads are installed in the space shuttle cargo bay vertically at the launch pad at NASA's Kennedy Space Center in Florida. The payload leaves a processing facility (far left) inside an environmentally controlled container that is hoisted to a changeout room on the Rotating Service Structure (middle). Once the payload is out of its container, the structure is then closed on the shuttle, protecting the payload as it is loaded into the bay.





- Solar Arrays
- Mobile Base System
- Starboard-zero Central Integrated Truss Structure
- Joint Airlock and High-Pressure Gas Tanks
- Space Station Remote Manipulator System (Canadarm 2)
- Multi-Purpose Logistics Module Raffaello
- Multi-Purpose Logistics Module Leonardo
- U.S. Laboratory Destiny
- Pressurized Mating Adapter
- Z1 Truss
- SPACEHAB
- U.S. Node Unity
- U.S. Node Harmony
- European Laboratory Columbus
- Dextre Robotics System
- Japanese Kibo Logistics Module
- Japanese Remote Manipulator System
- Kibo Pressurized Module
- Port Truss Structures
- Starboard Truss Structures

- Kibo Japanese Experiment Logistics Module Exposed Section
- Kibo Japanese Experiment Module Exposed Facility
- Light-weight

- Multi-Purpose Experiment Support Structure Carrier
- EXPRESS Logistics Carrier
- Cupola

Hubble et al.

Three of NASA's four Great Observatories rode to orbit in the space shuttle. The Hubble Space Telescope went up in April 1990, followed by the Compton Gamma-Ray Observatory in April 1991, and the Chandra X-ray Observatory in July 1999. (The fourth, the Spitzer Space Telescope, went up in 2003 on a Delta rocket.) Chandra was the heaviest of the four at 43,000 pounds, which included a 30,000-pound double upper stage.



The Hubble Space Telescope has had five service calls by spacewalking shuttle astronauts. The upgrades should extend its life to 2014; it will begin to fall from orbit in 2025.

Paying Customers

Commercial satellites were among the earliest payloads, with the first—the Satellite Business Systems and Canada's Telesat—going up on the fifth shuttle flight in November 1982. After the *Challenger* disaster in January 1986, NASA deemed such satellites, with their solid-fuel upper stages, a risk to safety. But astronauts could still make service calls. One of the most dramatic came in May 1992, when three spacewalkers grabbed an errant Intelsat satellite, attached a new motor, and sent it on its way.



Australia's AUSSAT leaves the confines of the cargo bay in August 1985. Satellites were also deployed for Canada, Mexico, India, and Indonesia.

- U.S. Node Tranquility
- Multi-Purpose Logistics Module
- Russian Mini- Research Module Rassvet



THE Drifters

**OF WIND, HELIUM, AND HOPE
(PLUS THE OCCASIONAL DISASTER).**

BY MARK KARPEL



LAST MAY 28, Jonathan Trappe became the first person to fly across a major body of water—the English Channel—while strapped to a cluster of balloons. Flight preparations had begun at midnight, assisted by an assortment of English balloonists, glider and airplane pilots, curious locals, and me.

I am a clinical psychologist, but my interest in people passionately drawn to unusual pursuits led me to cluster ballooning. Not many Americans have heard of it, except as a child's fantasy, or an image in movies like last year's Pixar feature *Up*, but the first actual cluster balloon flight dates back to the 1930s. Eventually, I became so drawn in I took a short break from my practice to volunteer as part of Trappe's ground crew for the Channel crossing.

The flight was covered by media around the world. The last cluster balloonist to generate that kind of attention was Larry Walters, a truck

driver who in 1982 strapped 42 weather balloons to a lawn chair and hurtled himself into the sky over southern California. On national newscasts that evening, Walters' story introduced an image of the cluster balloonist—part legend-in-the-making, part laughingstock—that remains largely intact. It's time to reconsider.

What follow are the stories of 10 cluster balloonists from the last seven decades. What were they seeking? Everything from novelty and adventure to scientific knowledge to celebrity and fame. But overall, they fall into two groups: seasoned balloonists and scientists on the one hand, and amateur dreamers and schemers on the other. The first group personifies Daedalus' caution and skill; the second, Icarus' sky-struck recklessness.

THE PIONEER

Of the sober-minded group, the most famous is Jean Piccard, a Swiss-born aeronautical engineer and balloonist who got interested in using balloon clusters for high-altitude research. (And yes, if you're wondering—Piccard was the inspiration for Star Trek's Captain Jean-Luc Picard.) At midnight on July 18, 1937, Piccard, 53, took off from Soldiers Field in Rochester, Minnesota, on the world's first documented cluster flight. His system was based on over 90 weather balloons. His ground crew included his wife, Jeannette, the first U.S. female balloon pilot licensed by the National Aeronautic Association, the couple's three sons, and 150 volunteers; 5,000 spectators strained to watch the proceedings.

Emergency fire trucks stood ready, since Piccard planned, over strenuous



When Jonathan Trappe wafted across the English Channel this year (left), he helped change the reputation cluster ballooning had gotten from the wild 1982 flight Larry Walters made in a lawn chair (above).

LEFT: NICK OBANK/BARCROFT MEDIA/GETTY IMAGES; RIGHT: DAILY BREEZE

objections from colleagues, to use TNT charges to release tie-down ropes and, on landing, to cut loose the upper cluster of balloons, filled with hydrogen—highly flammable in the presence of oxygen. He intended to level off between 2,000 and 3,000 feet and guessed that he would remain in the air for about seven hours, drifting 100 to 200 miles.

Two of his predictions proved accurate; the third one missed.

Piccard rose to 11,000 feet—over a mile and a half higher than intended. To descend, he pulled a few balloons down to the gondola and pierced them with a knife—the preferred means for serious cluster balloonists. Guns make good copy, but in the cold of high altitudes, balloons lose elasticity and are harder to deflate by gunshot. (Jeannette Piccard said that, when shot, sounding balloons “just get a small hole and sit there and smile at you.”) After six hours, Piccard landed in a farmer’s wood lot outside Lansing, Iowa.

THE DANCER

On September 9, 1954, residents of Albany, New York, looked up to see 60 balloons floating into the sky with a figure beneath. It was Garrett Cashman, a part-time hypnotist and dance teacher, and according to Lawrence Gooley, an authority on the Adirondack region, Cashman was seated on a piece of plywood that dangled from two clusters of balloons; between the clusters, a parachute was slung. Cashman had

brought along an anchor, sand for ballast, and a meatloaf sandwich. He rose to over 6,000 feet, floated for about 20 miles, and, immediately upon landing, was arrested for flying without a license and operating an unlicensed aircraft. He was jailed and later fined \$50 by the Civil Aeronautics Administration.

He later got both licenses and launched a career flying balloon clusters at airshows and auto races and as an advertising gimmick. After one rough landing in which he sprained his ankle, Cashman told reporters he “might quit the business,” adding, “I like to dance too well.”



Garrett Cashman was the first to make a career of cluster ballooning. This 1955 Missouri flight came close to 20,000 feet; the thin air made Cashman hallucinate.

THE HEIR

Twenty years after witnessing his father’s cluster balloon flight as an 11-year-old boy, Don Piccard launched his own cluster system. Piccard, co-founder of the first balloon club in the United States, also created the first super-pressure balloons—in which the



volume is kept constant as the pressure changes—and manufactured some of the safest and most distinctive hot-air balloons. For his first cluster flight, Piccard used balloons made of polyethylene film instead of rubber, explaining: “Gas balloons, old army balloons, were very big, very heavy, a lot of work, and took a lot of gas to fly.” By comparison, Piccard’s 40-foot-long methane-filled plastic cylinders were “fairly inexpensive, easy to handle, less work, and very safe.”

In September 1957, Piccard attached himself to 12 balloons and launched from Valley Forge, Pennsylvania. After about two hours, one of the balloons failed. Piccard threw some sand out to compensate, then decided to make a precautionary landing in a farmer’s cornfield. Now 84, Piccard continues to improve balloon systems, using tetrahedron shapes made of Mylar and nylon film, and is organizing a cluster balloon flight to the mesosphere, which begins at about 30 miles above sea level.



The first family of cluster ballooning: Jean and Jeannette Piccard with their sons, at the 1937 inaugural cluster flight.

LEFT: NASM (SI-77-14600); RIGHT: UNKNOWN



THE STARGAZER

In April 1959, an astronomer and expert balloonist modified Jean Piccard's design to become the first Frenchman to reach the stratosphere, which starts between eight and 15 miles up. Now 85, Audouin Dollfus is among the foremost French authorities on the solar system, the author of more than 300 scholarly papers, and the discoverer of Janus, one of Saturn's moons. He is also the son of Charles Dollfus, a famed French balloonist. Interested in observing planetary phenomena without the interference of atmospheric distortion, he organized a stratospheric flight in a sealed capsule with a compact telescope mounted on top. The capsule was suspended from a chain of 105 rubber balloons, each the size of a small truck, that rose nearly 1,500 feet in the air.

Dollfus launched at sunset from an airfield outside Paris. Two hours later, he wrote in his logbook, "I see a perfectly horizontal line—the tropopause, dividing the sky into two parts. The lower part, due to dust-borne



Unlike the flash-in-the-pan types, John Ninomiya (top) and Don Piccard (above) have put years into the pursuit.

particles, resembles an almost-phosphorescent sea whose brilliance surprises me," while above, "the air is perfectly pure, the stratosphere. The sky

is dark, despite the full moon, and the constellations shine without scintillation." His cluster had reached 46,000 feet—8.7 miles. When he finished his observations, Dollfus triggered explosive charges to release some of the balloons and begin his descent. Upon landing and stepping out into complete darkness, he felt something warm rubbing gently against his skin; it was the nose of a cow.

THE RULE-BREAKER

Thomas Gatch Jr., the son of a World War II naval hero, failed at nearly everything he attempted before seizing on the idea of being first to cross the Atlantic Ocean by balloon. He constructed a sealed gondola in his garage and attached it to 10 super-pressure gas balloons. Taking off from Harrisburg, Pennsylvania, in February 1974, he intended to ride the jet stream at 38,000 feet. His technical preparations, although extensive, were woefully inadequate for such an ambitious enterprise. According to William Armstrong, who handled his public relations, Gatch had only minimal training in hot-air balloons and none in gas balloons. He had never assembled all the components of his aircraft before the flight, and failed to either pressure-test the balloons at high altitude or float-test the gondola in water. He neglected to rehearse emergency procedures for a water landing, and he launched at dusk; had a problem surfaced early in the flight, rescuers would have had to search in darkness. He repeatedly ignored warnings from seasoned balloon pilots, he failed to get Federal Aviation Administration approval for his craft's airworthiness, and he notified authorities of the flight only after takeoff.

About an hour into the flight, the center balloon burst. Alluding to the company that manufactured them, Gatch griped to his ground crew, "Tell Raven I want my money back." Then he lost radio contact. Two days later, crewmen on a freighter in the mid-Atlantic were mesmerized by a ghostly silver sphere floating under a canopy of

TOP: ED STOCKARD; BOTTOM: TED RUSSELL/GETTY IMAGES



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JAVIER MERINO



In 1959, French astronomer Audouin Dollfus ballooned to the chilly stratosphere in a sealed capsule.

balloons 1,000 feet in the air—far below Gatch’s intended altitude and hundreds of miles off course. While they couldn’t see all of the gondola’s interior, what they did see showed no signs of life. Search parties were dispatched; they combed hundreds of miles of ocean for weeks. Neither Gatch nor his aircraft was ever found.

THE AMATEUR

Larry Walters had no training or experience as a balloon pilot, but according to Mark Barry, who manages the most authoritative Walters Web site (markbarry.com), the truck driver started preparing for his flight more than 20 years earlier, testing balloons’ lifting properties. And not long before the flight, he took a skydiving lesson. However, Walters had no license for the system he assembled, which consisted of 42 balloons roped to a Sears lawn chair. On July 2, 1982, in the back yard of a small home in San Pedro, California, Walters, then 33, readied for takeoff. He carried jugs of water for ballast and a BB gun to shoot the balloons as a means of descent.

Walters had tethered the chair with two cords to a 1962 Bonneville; he planned to hover close to the ground, safely roped to the car, until ready for free flight, but he had significantly

overestimated the amount of helium he would need. When one cord anchoring the chair was cut, the other one snapped from the strain, and Walters rocketed up to 16,000 feet. Soon commercial pilots were calling the tower at the Long Beach airport to report a guy floating three miles up in the airport’s approach path, sitting in a lawn chair and holding a gun.

Walters soon dropped the gun (which he had neglected to tie in) and drifted, shivering in the high-altitude cold, until he slowly began to descend. Coming in to land, he crashed into power lines, briefly blacking out power to part of Long Beach. FAA officials arrived at the scene to find him helplessly suspended in the wires. One of them later said, “We know he broke some part of the Federal Aviation Act

For his unauthorized – and uncontrolled – flight, Larry Walters was slammed with \$4,000 in fines.



and, as soon as we decide which it is, some type of charge will be filed.” For knowingly launching an unauthorized flight in a heavily populated area with congested air traffic, Walters was hit with \$4,000 in fines, later reduced to \$1,500. He never flew again.

If Walters had flown in a conventional gondola with 42 balloons, the reaction would have been mild amusement; the chair was something else. Few things say “up” less than a lawn chair. Walters transformed an object designed for daydreaming into a vehicle for actualizing his dream. The sheer originality of that act and the goofy charm of his low-tech aircraft made Walters a legend.

THE PUBLICITY HOUND

Yoshikazu Suzuki thought he could cross the Pacific Ocean under 26 balloons. The Japanese Civil Aviation Bureau questioned Suzuki’s plan. His emergency gear was inadequate and his balloons, filled with only 31,800 cubic feet of helium, were smaller than those used for standard gas balloon races and hardly enough for crossing the Pacific. According to Sabu Ichiyoshi, former chairman of the Balloon Federation of Japan, the only communication device Suzuki carried was a mobile phone, good only on land and within Japan.

He launched in November 1992 and was never heard from again.

“I don’t think he ever received any training to be a balloon pilot,” says Ichiyoshi. “It seems he was a person who likes to see media people.”

THE MAESTRO

John Ninomiya has made more cluster balloon flights than anyone living or dead—to date, over 60. An actuary with a Ph.D. in epidemiology, he was a licensed hot-air balloonist with hundreds of hours of flight experience when he made his first cluster flight, taking off from north of Los Angeles in 1997 with seven Mylar cells supplied by Don Piccard, who drove them from Minnesota to advise and assist.

Ninomiya says that he was drawn to cluster ballooning’s simplicity and purity. “It’s taking ballooning down to its simplest form,” he says. He also wanted to construct his own aircraft, one that could be flown safely and under reasonable control.

He typically uses between 50 and 150

The pre-Columbian Pyramid of the Sun in Teotihuacan, Mexico, is a stunning backdrop for a 2008 John Ninomiya flight.

balloons, along with a harness like those favored by paragliders, allowing him to “walk around up there” and to land on his feet. For a balloon and wine festival, Ninomiya has flown under purple and green balloons rigged into the shape of a grape cluster, an arrangement he dubs The Concord.

To burst balloons, Ninomiya carries knives on a lanyard around his neck, “because you don’t want to drop your knife.” Although he has flown as high as 21,400 feet, recreational flights are usually under 5,000 feet.

THE PRIEST

Father Adelir Antonio de Carli, a Catholic priest in Brazil, decided to take off under 1,000 balloons in order to raise

The dark side of cluster ballooning: In 1992, Yoshikazu Suzuki took off over the Pacific and was never seen again.



funds for a religious charity. De Carli registered at a flight school but refused to attend theory courses, including those on weather, and dismissed his instructors’ warnings about prevailing winds. One teacher characterized him as “undisciplined...not humble at all...the know-it-all guy.” Video clips of his April 2008 takeoff from the port city of



Parangue reveal crowds standing under a gray sky in a steady rain. When asked about the ominous weather, de Carli responded, “There will only be good weather during my flight.”

Intending to fly 450 miles inland, he was instead immediately blown out over the Atlantic Ocean. Eight hours later, he was losing altitude and asking how to use his GPS unit—one of many preflight safety procedures he had ignored. He soon lost radio contact. Search parties found his balloons and, two months later, his body. “The Brazilian priest was a complete idiot,” says Don Piccard. “To take off with an offshore breeze and go at altitude with no control and no way to deflate...”

THE HISTORY-MAKER

Before his first cluster balloon flight, Jonathan Trappe spent one year preparing. A technical projects manager from Raleigh, North Carolina, Trappe trained with hot-air as well as single-cell gas balloons. He performed multiple unmanned tests to ascertain the altitudes at which balloons with various amounts of gas would burst, and whether one burst would lead to a chain of others. He wanted to know how many balloons to sacrifice in order to reverse a climb without precipitating a dangerous descent. He researched all Federal Aviation Administration and local air regulations. On June 7, 2008, he took off from Franklin County, North

In addition to the 10 in this story, other cluster fliers, such as Oregon’s Kent Couch, are refining the sport (above, his team works the helium tanks). Below: A Flytec instrument lets Trappe measure altitude, temperature, and rate of climb.



LEFT: COAST GUARD OF JAPAN/TOKYO SHIMBUN 12/19/92; TOP: SMART SOLUTIONS, SMART2.COM; RIGHT: COURTESY JONATHAN TRAPPE

Carolina, and flew for four hours, reaching 15,000 feet and traveling about 50 miles.

Trappe's original cluster balloon aircraft consisted of a standard Steelcase Uno office chair (the one he used for work every day) and 50 or so chloroprene balloons, plus assorted other gear. Chloroprene is a mixture of latex and neoprene—the material used to make wetsuits—and the mix, says Trappe, “makes a nice ‘boingy’ balloon.”

Trappe's multiple-balloon system, now featuring a modified climbing harness in lieu of the office chair, is the only one to be granted an Airworthiness Certificate by the FAA, allowing him to fly legally during darkness as well as daylight. Last April 10, he launched at dusk over Raleigh for the first official overnight cluster balloon flight. Landing at dawn 14 hours later, he completed the longest-lasting

cluster balloon flight on record.

Just after dawn on May 28, Trappe set out to cross the 22-mile-wide English Channel. Earlier attempts to cross large bodies of water with cluster balloons had cost three men their lives.

With 54 balloons, he took off at dawn from the Kent Gliding Club—the highest elevation in that part of the United Kingdom. Floating over Dover Castle (near where Louis Blériot landed in 1909 on the first airplane flight across the Channel), he passed over the white cliffs of Dover before heading out over water. He flew as high as 7,500 feet but descended at one point to just over 300, where he was able to hear the waves. A picture-perfect flight ended in a hectic landing: To avoid restricted airspace and a looming tower, Trappe had to knife some balloons to descend quickly. He set down in a farmer's field in northern France, less than two miles from the

Belgian border, and was immediately surrounded by French policemen, who threatened to detain him and his crew until they were convinced that he had not violated French airspace.

THE MOST COMMON reaction when people watch a cluster balloon launch is a giddy, incredulous grin. Cluster ballooning evokes freedom, adventure, escape, breaking away from conventional expectations. The low-tech nature of the aircraft—akin to an aerial soapbox racer—adds to its innocent charm.

The sport does have a controversial image, largely due to the press' focusing on inexperienced practitioners; that's roughly equivalent to condemning driving because an unlicensed teenager crashes his dad's car. Those who have done it right have shown it can be a very safe form of flight.

It is, however, expensive and organizationally complex, costing between \$2,500 and \$4,000 to launch one flight, without counting costs for reusable items, such as a parachute, transponder, and oxygen tanks. Then there is crew. Ninomiya, for example, says, “I need 15 people for the period of two hours” to inflate and assemble all the balloons. For these reasons, cluster balloonists often look for sponsors, such as balloon festivals and airshows. At venues like these, costs can be subsidized and volunteers mobilized for preflight operations.

The payoff for the balloonist? Jonathan Trappe says that the allure of cluster ballooning is in large part the silence. “We don't even get the sound of the wind,” he says. “We move perfectly with the wind.” And he points out that cluster ballooning closely resembles how people experience flying in dreams: “floating in the open sky, looking down in silent observance of the world below.”

As for the spectator, he gets to leave the venue with a vivid, indelible memory: the image of someone floating silently into the sky, under a colorful bouquet of beautiful, boingy balloons. —



MY MOTHER STILL SMILES OUT AT ME from a small black-and-white photo on my bookshelf. In the picture, she is a prim young woman in a crisp white shirt and smart pinafore. You can just make out a set of wings—her first—pinned to her chest. It is 1939, and she is only 17 years old. That gleam of silver over her heart and her grand smile say it all: She had achieved her dream. She could fly.

My mother, Geraldine “Jerry” Hardman Jordan, was one of the Women Airforce Service Pilots of World War II. She knew she wanted to be a pilot from the time she was five years old, and she could pinpoint the moment she made that decision: May 22, 1927. On that day, she was at her grandparents’ farm outside the tiny town of Ontario, Oregon. The farmhouse had no radio or telephone; when major news broke, a neighbor simply saddled up his horse and rode from farm to farm to spread the word. The news he brought that day: Charles Lindbergh had flown across the Atlantic and landed in France. As my mother would tell us again and again, when the neighbor rode away, she looked up and said, “That’s what *I* want to do.”

With encouragement from her father and brother, Mom began flying when she was 15. Her uncle, a larger-than-life character named Casey Jones, was a pilot; he ran the small airport in Ontario, and let Mom work at the field. Her first paycheck went to buy a pair of jodhpurs and riding boots, so she could be decked out like her hero, Lindbergh, but after that, every dime of her pay went toward flight time. She did all the airport scut work imaginable: sweeping the enormous hangar, washing airplanes, and—in a demonstration of true dedication—cleaning the inside of Casey’s airplane after he’d taken passengers with fragile stomachs up for their first flights. In return, Casey gave her

flying lessons. “I took my time however I could,” she told me. “Fifteen minutes here, 20 minutes there—whatever I could scrounge up the money for.”

Casey had spent some time barnstorming and had a surplus Curtiss Jenny that he used to teach her the basics. “We’d pick out a straight line on the ground, like a road, and fly back and forth making S turns across the road,” my mother explained. “Our favorite entertainment was to fly over the mountains of Idaho and look for landing spots.” On one of these trips, her pocket change hadn’t bought quite enough to fill the tank, and she and Casey had to make an unscheduled landing in a farmer’s field. She told me about chasing away cows, eager to lick the Jenny’s fabric skin, while Casey hiked to the nearest town for gas.

In 1939, the University of Nevada at Reno was granted 20 slots for Civilian Pilot Training Program (CPTP) trainees. Ostensibly established to increase general aviation opportunities, the unspoken message of the CPTP was clear: As conditions deteriorated in Europe, the country needed a pool of well-trained pilots ready to take on military duties. My mother, who had graduated high school early, was working as secretary to the university president. Nineteen young men came forward for the training at the school that year, leaving one slot open, which Mom took. The program provided a 72-hour ground school and 35 to 50 hours



of flight instruction. My mother earned her pilot’s license that year, but after war was declared in 1941, pilots had to prove their identity to get a wartime aviator’s ID. She couldn’t produce a birth certificate, and struggled for a year to get authorized to fly. At the same time, efforts were under way in Washington, D.C., to put America’s female pilots to work for the war effort.

Nancy Harkness Love and Jacqueline Cochran had both submitted plans to use female pilots in non-combat missions. Love established the Women’s Auxiliary Ferrying Squadron (WAFS) with the support of Colonel William H. Tunner, commander of the Army Air Forces Air Transport Command. While Love oversaw the WAFS out of New Castle Army Air Base in Delaware, Cochran set up the 319th Women’s Flying Training Detachment at the Houston Municipal Airport in Texas. By mid-1943, the two groups were merged into the WASP, training at Avenger Field in Sweetwater,

Geraldine Hardman (above, in 1939) would go from newly minted aviator to experienced ferry pilot, delivering B-25Js (like the one opposite) out of Fairfax Field in Kansas City, Missouri.

FLYING BOMBERS *in* World War II

Stories my mother told me. *by Melissa Jordan*



PHOTOGRAPHS COURTESY MELISSA JORDAN; LEFT: NASM (SI-95-572)



Texas. Eventually, 25,000 women would apply for WASP training. Just over 1,800 applicants were accepted; only 1,074 would complete the program.

In assembling the WASP program, Cochran and her staff scoured the records of the Civil Aeronautics Administration to find female aviators to participate. They discovered 2,733 licensed U.S. female pilots in the files, and sent them telegrams inviting them to apply for the WASP program.

Mom was assigned to Class 43-W-5, the fifth WASP training class and the first group to go through all of its training in Sweetwater. Arriving there, the women discovered the military was ill-prepared to accommodate female aviators. The WASPs were issued men's surplus mechanics' overalls—in sizes 44 and up—which the women quickly dubbed “zoot suits.” One of my favorite photos of my mother is her in her baggy zoot suit, soaking wet and grinning like crazy, after going through an Avenger Field ritual: a

dunk in the field's wishing well to celebrate a successful solo flight.

WASPs went through 22 1/2 weeks of training as rigorous as the training male Army Air Forces cadets received, but the women skipped gunnery and formation flying. Simply surviving training could be risky: 11 women died before reaching graduation. My mother told stories of near disaster, such as climbing into airplanes that were sometimes missing pieces of equipment here and there. Once, during a posting to New Castle Army Air Base, she tried to land an AT-6 at night. The whole flight had been beset by mechanical problems, and, on approach, neither my

Thirty-eight WASPs died in service. Mary Hartson (left, with Hardman, center) was killed in a BT-13 crash in 1944.

mother nor the tower could tell if the landing gear was down. Mom described flying that Texan in circles over the Atlantic Ocean for more than an hour to burn excess fuel. She was terrified upon landing, but to everyone's relief, the gear was locked down and all was well.

Although the work carried significant risks, that time in my mother's life created some of her most treasured memories. When she talked about her WASP days, she always said that she would not have traded the experience for anything. “I

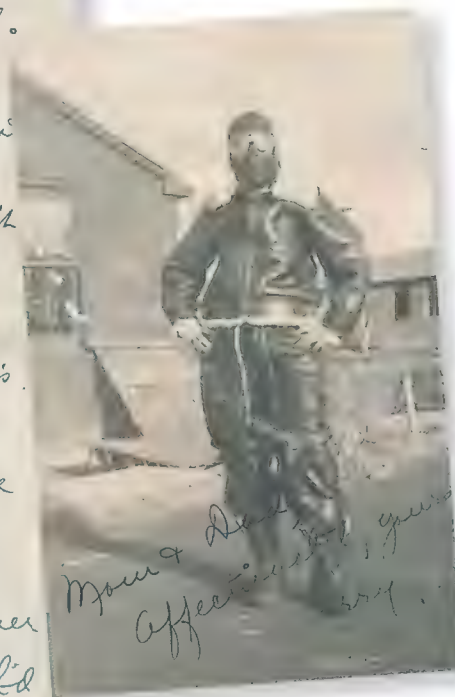
Hardman's letters home described the peculiarities of various aircraft (checking out in the AT-17, right) and “glamorous” winter outfits, far right: “What a good-looking daughter!”



2/14/44
Hagerstown, Md.

Dear Mom & Dad,

Well, here I am again “weathered.” This time there's a lovely snow storm covering most of the East Coast so don't expect to get out for a day or so. It stopped snowing this morning long enough for us to get checks in PT 19's. Every 60 days that happens. I was really stinky in it but the Lt. let me get away with it. Wait till he finds out I'm going solo—hell probably take me up for a few hrs. Deal. Never realized how behind the 19 was till I'd flown the 26. They sure picked a swell time of the year to start ferrying open ships again. One thing, it's going



just loved it," she would say. "If I had to pay them for the privilege, I still would have done it." She talked not just about her love of flying but also about the satisfaction of carrying out a patriotic duty.

Mom graduated from training at Avenger on September 11, 1943, and was posted to the Air Transport Command at New Castle Army Air Base. During her time in the WASP, she flew Vultee BT-13 trainers, Cessna AT-17 Bobcats, Douglas C-47 transports, and, later—much to her delight—North American B-25 Mitchell bombers. "Most of us would never have gotten near these planes any other way," my mother once said. "Who would have had enough money to put gas in a B-25?"

On occasion, the women's challenges were compounded by chauvinism. With great amusement Mom told me a story in which she and several other WASPs delivered aircraft to a coastal base. After approaching the field in tight formation, the pilots executed a series of flawless

landings. When the women hit the hangar, the mechanics were laughing. The ground crew explained that a rather blustery Navy officer had watched the WASPs approach and land. He'd declared that because of their precision and skill, the group *had* to be Navy men. When the women started hopping out of the airplanes, the officer's face burned red. Embarrassed, he didn't stay to commend the pilots on their expertise.

But sometimes the bigotry led to sabotage, as my mother wrote in a letter home:

"Yesterday it cleared up enough for me to take off so I tore into my zoot suit, snagged a Red Cross car for my bags & went out to the line—no PT19A—no little silver ship in sight ever—nothing but B26's and dive bombers! An hour later when it was too late to take off, I finally located my baby in sub-depot minus a prop & with a big hole in the wing which 2 mechanics & the cap't in charge were frantically covering. I've never yet gotten the story but somebody sure did me dirt!"

Thirty-eight WASPs died in service, including several of my mother's classmates. Paula Loop, one of her dearest friends, died in the crash of a BT-13 near Medford, Oregon, and Mom was dispatched to escort her body home to Oklahoma. As civilians, the WASPs received no benefits and had no right to a military funeral—not even a flag for the coffin.

When Mom's brother Franklin, a naval aviator, was lost in the Pacific theater late in 1943, she requested a transfer to a western base to be closer to her family. But coming back to New Castle after a ferry mission early in 1944, she discovered the WASP barracks empty; her entire unit had been assigned to another base to fly pursuit aircraft. She had not been sent on to pursuit school because she'd already requested a transfer. For

Avenger Field, an all-female Texas air base, was nicknamed "Cochran's Convent," after WASP leader Jackie Cochran.



her whole life, my mother regretted the decision. "I opened my mouth when I shouldn't have. I would have been in fighters otherwise. People make their mistakes. I wish I hadn't made that one."

While waiting for her westward transfer to go through in the spring of 1944, Mom was chosen to go to Orlando, Florida to participate in the WASP's first Officer's Training Course. Efforts were under way to militarize the program and grant commissions to the women. But male civilian pilots, fearing a loss of their draft-deferred status, lobbied hard against the militarization bill, and opposition grew in Congress. The press railed against the women, calling them "the powder puff brigade" and questioning their value to the war effort. By June 1944, the militarization bill was defeated in Congress, and by October, the remaining WASPs were informed that the program would be shut down in December.

While the training course in Florida kept my mother from the chance to fly fighters, it opened another door for her. Just a few days after arriving in Orlando, she met a young officer on a weekend trip to Daytona Beach. A whirlwind romance led to a June wedding, and in just a few weeks, my mom was expecting her first child. She didn't want to stop flying,

but a side effect of her pregnancy was altered depth perception; she found herself landing airplanes above—and not on—the runway, so she tended to overshoot the landing. "Hard on plane and pilot," she explained. WASPs had married and gotten pregnant before, but while other women in those circumstances had been granted a leave of absence, Mom wasn't told that she could take one. With no other alternatives, she resigned from the WASP in August 1944. She was not allowed to write—or even sign—her own resignation letter. In a box of my mother's papers, I found a copy of that cold form letter, stating that she wanted to quit simply to be with her husband. Years later, her frustration over the resignation boiled over, and in 1979 she wrote a letter to the Air Force noting that she "resented the implication that [she] would quit for a frivolous reason." The only response she got was a form letter and instructions for applying for her honorable discharge.

On December 20, 1944, the WASP organization was disbanded; the women had to spend their own money to get home. Their groundbreaking, patriotic work swept into the footnotes of history, many of the pilots were embittered. It



WASP trainees (Hardman, fourth from left) decked out in baggy "zoot suits" in 1943. Two of the six would wash out.

would take 33 years for the women to be granted veteran status through an act of Congress.

By 1950, my mother had three young children. She had not given up her aviation ambitions, though. She told me that on the day she took the exam for a commercial license, she had no money for a babysitter. The only woman in the room, she took the test with an infant over her shoulder.

Eventually, though, with a rapidly expanding household of rambunctious children and a shoestring budget, my mother realized her aviation career had ended. It was a choice, she said, she was happy to make. She had grown up in difficult circumstances, without the love and attention of her own mother. While flying was her passion, she was willing to pass up time in the cockpit to lavish affection on her kids. I always admired that my mother never seemed bitter about giving up her wings. While she never denied that she missed being in the cockpit, she never resented her kids for grounding her. Rather, she was determined to expose me to as much of her flying world as possible.

As we grew up, our mother's anecdotes about WASP life became part of our everyday lives. My mother had been indelibly marked by her wartime experience, and stories of flight and the war were as commonplace to us as fairy tales are to other children. But as the last of nine kids, I know I was, in many ways, more fortunate than my older brothers and sisters. My mother was 44 years old when I was born, her hair already salt-

B-25J EXAMINATION
NAME HARDMAN, GERALDINE RANK WASP DATE 31 MAY 1944

PART I - MULTIPLE CHOICE -

1. Full capacity of the B-25 without bomb bay tanks is
(1) 894 Gals (3) 1189 Gals
(2) 974 Gals (4) 960 Gals
2. Fuel from the auxiliary tanks is used by
(1) Pumping to rear main tanks and flaming through check valve to front main tanks.
(2) Pumping directly to engines by use of electric auxiliary pumps.
(3) Pumping to front main tanks by use of electric pumps.
3. Fuel from the rear main tanks flows
(1) Either into the front tank or directly to the engines for consumption.
(2) Through a gravity check valve to the front main from which it is pumped to the engines.
4. Oil is supplied from
(1) Individual tanks for each engine capacity of 37 gals each.
(2) One tank of 60 gals capacity.
5. Normal oil pressure is
(1) 70-80 lbs. (3) 90-100 lbs.
(2) 80-85 lbs. (4) 100 lbs
6. Fuel pressure without booster pumps on should be
(1) 6-7 lbs. (3) 22-4 lbs
(2) 16 lbs (4) 9 lbs
7. Hydraulic pressure for the general system should be
(1) 600-800 lbs (3) 400 lbs
(2) 1000-1200 lbs (4) 800-1100 lbs
8. Brake system hydraulic pressure should be
(1) 400 lbs (3) 1000-1200 lbs
(2) 500-600 lbs (4) 800-900 lbs
9. Accumulator air pressure should be
(1) 400 lbs (3) 250 lbs
(2) 16 lbs (4) 550-600 lbs
10. The purpose of the accumulator is
(1) To maintain constant hydraulic pressure and absorb shocks in line.
(2) To supply emergency pressure for brakes.
11. The pressure of the emergency air brake system should be
(1) 650-700 lbs (3) 400 lbs
(2) 550-600 lbs (4) 100 lbs
12. Application of the emergency air to the brakes should be:
(1) With short snappy applications.
(2) By releasing all the pressure at once for a quick sure stop.

Flight training (Hardman's B-25J exam, left, and WASP ID, below) included day and night navigation, instrument training, target and glider towing, and radar calibration.

WAR DEPARTMENT
FERRYING DIVISION, AIR TRANSPORT COMMAND
NEW CASTLE ARMY AIR BASE
WILMINGTON, DEL.

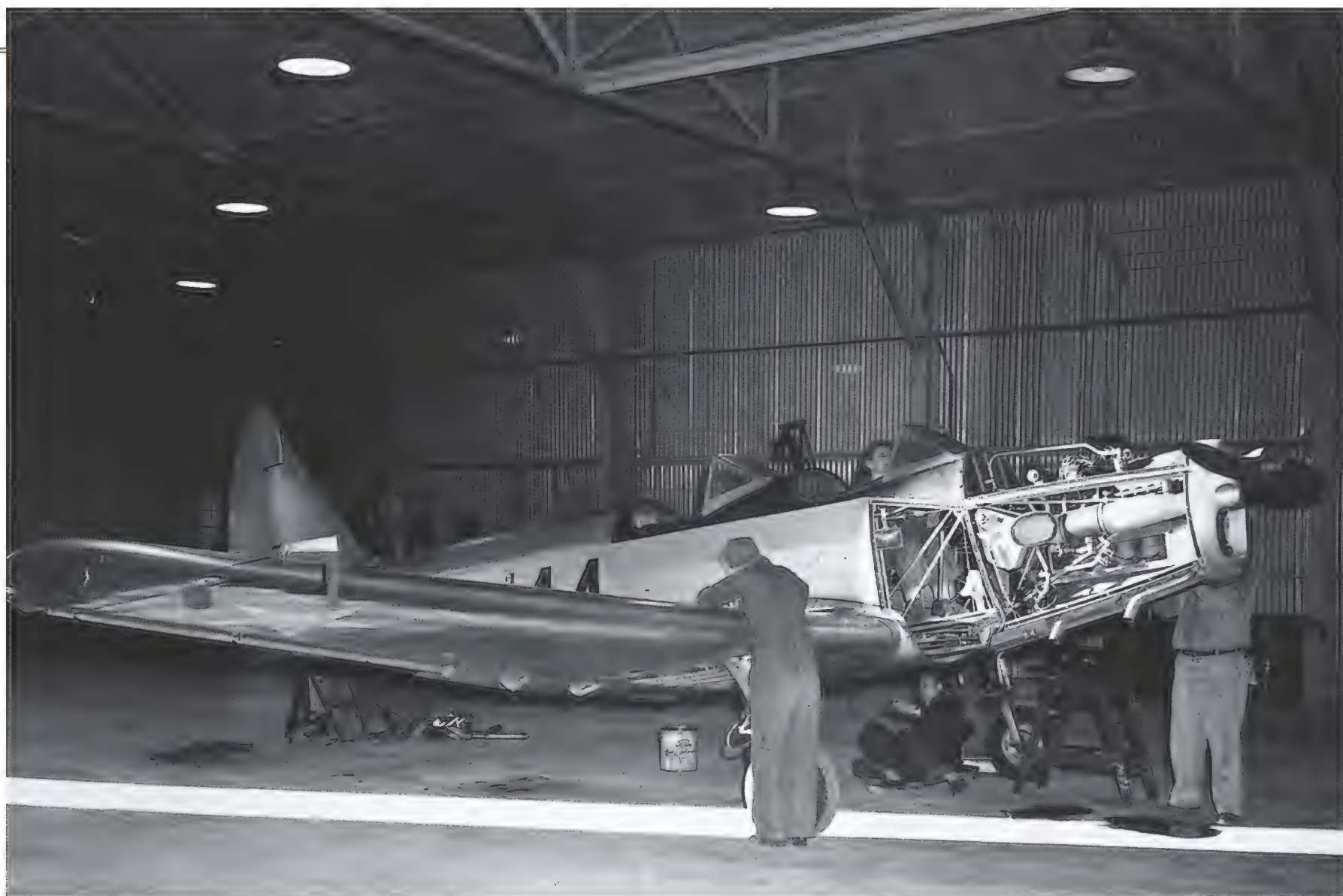
This is to certify that Geraldine N. Hardman whose signature, photograph and description appears hereon is a civilian pilot employed by the Ferrying Division, Air Transport Command.
Signature of Pilot Geraldine N. Hardman Date Issued 11/8/43

GERALDINE N. HARDMAN
WASP

Date of Birth Sept. 3, 1904
Color Eyes Green
Color Hair Brown
Weight 125
Height 5' 5 3/4"

The holder of this identification is authorized to fly the following types of aircraft:
General C. M. Laughlin
Rank 1st. Colonel, A.C.
Commanding Officer
2nd Ferrying Group, F.D., A.T.C.

Note:
The civilian pilot who holds this card will not be paid or employed by the F.D., A.T.C. without presentation of this identification.



NASM (SI-A-4569-A)

and-pepper when I was in grade school. No longer chasing a whole herd of kids, she had more time to tell me her flying stories and share her memories.

My childhood was punctuated with airshows, visits to aviation museums, and WASP reunions. I was named for one of Mom's classmates, as was my sister Mary. I loved seeing her with her friends, bound by a unique experience. Virtually no one outside our family knew Mom was a pilot, so the reunions raised her spirits.

When I was five, our family moved from New Jersey to Moline, Illinois. While my teenage sisters were less than thrilled to leave the East Coast, for a grounded pilot, Moline was a choice spot to land: small airport, an easy four-hour drive to Oshkosh, Wisconsin, and—just an hour down the road—Galesburg, Illinois, home of the National Stearman Fly-In. Together, my mother and I painted compass roses at small rural airstrips and washed airplanes to raise money for the Moline chapter of the Ninety-Nines, a women's flying group. She taught me about map reading, using a silk map of the China-Burma-India route, given to her by a pilot who'd flown the Hump, the

Hardman ferried primary trainers like the PT-19 above. In 1997, female Air Force officers paid her an impromptu homage.

eastern end of the Himalayan Mountains. She quizzed me on aircraft silhouettes, and taught me the basics of flying. Now and then, if she got wind of a unique aircraft making a stop at our airport, she'd pull me out of school to see it.

As the years went on, my mother's body could not keep up with the sharpness of her mind. In 1997, she flew out to join me in Washington, D.C., for the dedication of the Women in Military Service for America memorial at Arlington National Cemetery. Using a wheelchair, and with her vision fading, she found the trip challenging, but she told me she wouldn't have missed it for the world. That journey was my mother's last time on an airplane. The female pilot of the flight out of Washington was so thrilled to have a WASP on board, she called for a standing ovation from the passengers and brought my mother up to check out the cockpit. Mom was exhausted, but she wasn't about to pass up



a chance to check out the controls on a jumbo jet.

At the dedication, I watched my mother beaming with quiet pride as astronaut Eileen Collins, who would go on to become the first woman to command a space shuttle mission, addressed the crowd of thousands, singling out the WASPs for their inspiration and for breaking down the barriers against women's careers in aviation. Dozens of people recognized the distinctive wings on Mom's jacket and approached her. They came up to shake her hand, thank her for her service, and to take a picture with her. It was a remarkable moment in a life lived largely in the shadows of history. —



AT THE PIMA AIR & SPACE MUSEUM, THE B-36
IS THE LARGEST U.S. WARPLANE EVER REBUILT.

PHOTOGRAPHS BY MARK BENNETT AND SCOTT YOUMANS

Monster

BOMBER

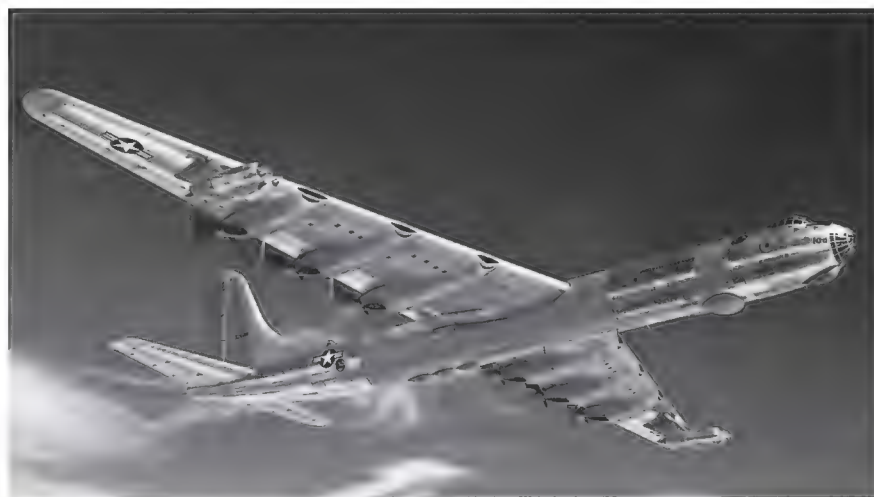


▶ Pima's B-36 served with the 95th Bomb Wing at Biggs Air Force Base in El Paso. Here it awaits takeoff from Biggs on its final flight: to Fort Worth.

▶ A jet engine pod, a chunk of fuselage – to be shipped, the bomber had to be broken down into pieces that filled 11 trucks.



IT WAS THE END OF THE LINE. Convair B-36 Peacemaker 52-2827, later named the *City of Fort Worth*, was the 383rd of 383. The nuclear bombers, designed for use in World War II but not finished in time, were intended for transatlantic strikes against Germany. With a range of 6,000 miles and a bomb payload of up to 86,000 pounds, they were built huge—the wing spanned 230 feet, and had almost three times the area of a B-29's. B-36s served from 1948 to 1959. After retirement, 52-2827 was sent to Fort Worth, Texas, where over the years it was besieged by weather and vandals. In 2005, the Air Force reallocated it to Tucson, Arizona's Pima Air & Space Museum, which spent four years restoring it, a job that required, among other things, 5,000 nuts and bolts and 3,000 rivets.



NATIONAL MUSEUM OF USAF



SCOTT YOUNG

▶ B-36s were unusual in that much of their skin was made of dull magnesium, rather than shiny aluminum. The material is plentiful and has a high strength-to-weight ratio, but it corrodes easily. When *Fort Worth* arrived in Arizona, parts of its skin were in bad shape; right: a section of the tail.



COURTESY PIMA AIR AND SPACE MUSEUM (2)

▲ *Fort Worth*, a B-36J, basks in restored glory.

▲▲ The D model (flying) was the first B-36 to add jet engines to its radials.

▶ A restorer sands one of the six flaps (two are shown). The flaps had a total surface area of 519 square feet – 48 percent more than the flaps of the B-29 bomber.





MARK BENNETT

◀ The interior of *Fort Worth's* wing, pre-restoration. At its root, a B-36 wing is more than seven feet thick. Crewmen could enter the interiors in flight and get to the engines or landing gear. The B-36's wings were the longest of any combat aircraft in history.



◀ Each turbojet nacelle had a streamlined air plug (the cone-shaped object), to minimize drag when the jets were not used, and shutters that prevented excessive blade windmilling during cruise.

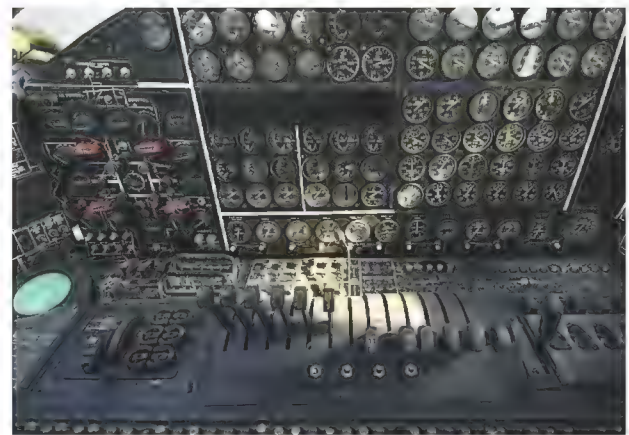




MARK BENNETT (3)



SCOTT YOUNG



▲ The instrument panel for the two flight engineers.

▲▲ In the nose, the large round panel marks the former location of a window for the optical bombsight, replaced with a sight that used radar.

◀ Purists point out that the present incarnation of B-36J no. 52-2827 isn't 100 percent accurate: To help increase speed and cruise altitude, the Air Force had the last Peacemakers made without drag-inducing sighting blisters (the raised dome near the cockpit, installed during an earlier restoration, in Fort Worth).



MARK BENNETT (3)

◀ Inlets to feed air to the radial engines were incised in the wings' leading edges, minimizing drag.

▶ The 19-foot-diameter propellers were aft-facing, so the prop wash would not disturb airflow over the wings and increase drag. The pusher arrangement helped give the bomber intercontinental range.





BUILD-IT-YOURSELF HELICOPTERS

IF YOU HAVE 700 HOURS TO SPARE AND CAN SHIM A ROTOR ASSEMBLY TO WITHIN .001 OF AN INCH, HERE'S A HOBBY FOR YOU.

BY JAMES R. CHILES | PHOTOGRAPHS BY JOE LOXTERKAMP

WHEN SOMEONE SLAPS DOWN A HUNDRED GRAND for a vehicle—a cigarette boat, say, or a sports car—there is usually some kind of red-carpet handover: a hearty handshake along with the keys, then a captain's cap or a bottle of wine.

Not when the vehicle is a kit-built helicopter. In March 2009, Rod Harms' helicopter-to-be arrived in eight crates stacked outside his ranch-style house near Pekin, Illinois. The delivery service left them in the nearest open space: the road. "Not *by* the road, *in* the road," says Harms. He called a friend to help hustle them out of traffic. The delivery, just eight days after the order had been placed with RotorWay International in Arizona, caught

Harms with his hangar incomplete.

Four months later, he has finished the hangar, along with much of the aircraft's frame and cabin. Bright, spacious, equipped with workbenches, power tools, and a concrete floor, Harms' hangar is close to his house: His wife signed off on the project on the condition that he not build it after hours at his auto-body shop—she had the wifely intuition that she might not see him for months of Sundays.

One big crate stores dozens of lumpy, shrink-wrapped cardboard sheets. This is how RotorWay packages smaller parts like snap rings, pins, nuts, and bolts, which if shipped en masse in plastic bags could wind up in the wrong holes. Every part has a unique number to match a step in RotorWay's notebooks and DVDs.

First clamoring for notice in brash, optimistic magazine ads of the 1950s ("Easy!" "Fun!" "Anybody who can ride a bicycle can fly this!"), the first viable home helicopter products came from Buford J. Schramm and Robert Everts, who designed the Scorpion (first named the



Kit-copter pioneer B.J. Schramm (opposite, at left) gives Homer Bell tips on the blade grips on Bell's Helicycle in 2003. Bell has built a Scorpion Too and an Executive, complete with trailer (above). Schramm (now deceased) had his first success in 1967 with the Scorpion (left).

Javelin) and began selling it in 1967 to hobbyists who wanted recreational rotary-wing flight but didn't want to go the gyrocopter route with Bensen, Barnett, and other brands, or couldn't afford a factory-built model. Two-seater Scorpion and later Helicom kits were challenging even for the mechanically gifted, but cost less than \$7,000 in 1975, one quarter the price of a Hughes 300 two-seater. Although this entry-level niche took a hit when the \$40,000 Robinson R22 production helicopter debuted in 1979, the homebuilt industry still sells hundreds of kits per year for construction under

the Federal Aviation Administration's amateur-built, experimental category.

According to Homer Bell, who taught himself to fly in a two-seat RotorWay Scorpion Too in the first wave of kit-copter enthusiasm and is now a consultant to home helicopter builders, "There's no single type of customer. They're all over the place—doctors, farmers, not just people who don't have enough money to get a production machine." The kit helicopter community is much smaller than the fixed-wing kit builders, but the skills cross over: It's not unusual to find helicopter builders whose stables house a Van's

RV-10 or other homebuilt airplane.

When all checks are done and forms completed, the customer finds that he or she is the manufacturer of a new aircraft, as well as its mechanic, notwithstanding the lack of an airframe-and-powerplant license. This has its pros and cons. On one hand, the sellers of such kits can be agile and adaptive, which helps keep production costs low. They can choose to ship whatever engine suits their fancy, or can leave the choice to the buyer, who could use a rotary engine from a Mazda RX-7 if he could adapt the power train. Since the FAA does not certify unassembled kit helicopter models as airworthy, it offers no opinion on such matters. On the other hand, in case of mishap, the customer's number-one legal target is himself, as manufacturer and chief mechanic.

The word "kit" may conjure up childhood memories of assembling a Revell model from a cardboard box, building up each rotor with blades and a tube of glue. But when it comes to full-size helicopters, "build" is a more appropriate verb than "assemble." While some parts must be cut, trimmed, or drilled, no arcane skills are necessary. It helps to start with a well-equipped workshop, a methodical style, and a familiarity with engines. Some com-

panies, like Hummingbird maker Vertical Aviation Technologies, let customers add bucks to move up to a “quick-build kit” that cuts down on workshop time. But speed is not the point. Think of a big watch: RotorWay wants its customers to wield a micrometer and paper-thin shims to bring the hub and attached rotor blades (which stretch 25 feet tip to tip) to within .001 inch of perfect center.

Orv Neisingh (in pilot's seat) and Andrew Burr, of Vertical Performance Systems, have built a new engine for experimental helicopters and light sport airplanes. They first tested it in a highly modified RotorWay Executive named Frankenstein.



COURTESY ORV NEISINGH



Hap Miller (in orange shirt) and helpers remount the blades and fins on Miller's Helicycle, which he trailed to Bell's fly-in from California. A Helicycle borrowed a RotorWay cover to help it through the night (left).

A600 Talon from crate to flight, a new-comer is likely to spend twice that, or more. I heard tales of people for whom a decade of tinkering wasn't enough. (Ads for the notorious Mini-500 single-seater kit from Revolution Helicopters claimed that owners could build one in 40 to 60 hours, but after a spate of well-publicized fatal crashes, hard landings, and hard feelings, Revolution folded in 1999.)

Five companies dominate the North American market. Three make kits in the United States—RotorWay sells the Talon; Eagle R&D, the Helicycle; and Vertical Aviation Technologies, the Hummingbird—and Canada has two brands, Safari and Mosquito. (B.J. Schramm founded RotorWay in 1961 and Eagle R&D in 1998; he died in 2004 in the crash of a Helicycle, but his wife heads his second company.) Kits with engines sell for about \$28,000 for the entry-level, single-seat Mosquito to \$200,000



“Some people should only be building wheelbarrows,” says Al Behuncik, a RotorWay dealer in Alberta, Canada. “Their attitude is, ‘Well, it looks good enough to me!’” Behuncik spent 27,000 hours building and flying the four aircraft in his “copter barn,” coming up with improvements for the factory to adopt. Meticulous in his work, he has the gentle manner of a wrench-

wielding Mr. Rogers, but his tone changes when discussing problems that are, in his view, easily avoidable. Behuncik says he sees two personalities that tend to get into trouble: “One is the person with no mechanical ability. The other is someone who just wants to get it done.”

While an old hand like Behuncik plans on spending 350 hours to bring a new



for the four-seat Hummingbird, a kit version of the Sikorsky S-52. RotorWay dominates the field, having shipped its first kit helicopter, the Scorpion, in 1967.

HOMER BELL IS A HOSPITABLE soybean farmer who moonlights as a traveling troubleshooter for kit-helicopter owners; they know him by first name rather than last. Since Bell doesn't hold an airframe-and-powerplant license, his official role is more mentor than mechanic.

Bell spent two and a half years on his two-seat RotorWay Scorpion Too, flying it at the 1975 Oshkosh show. B.J. Schramm had priced the Scorpion low enough to attract newcomers like Bell: \$6,900 for the complete kit, including an Evinrude outboard motor. But Scorpion buyers opened the boxes to find raw material waiting to be cut, bent, and joined into a fuselage per the blueprints. Would-be pilots besieged Schramm's RotorWay firm for help.

"He was taking calls 24/7 from customers," recalls Bell, who was a technician for National Cash Register when Schramm invited him to be a dealer and earn commissions. "Pretty soon I was spending three to four hours a day on the

phone, into the evening, and also working third shift," Bell says. "I told B.J., 'I'm spending too much time on this. Let me out of this dealer deal.'"

The solution: Bell would keep offering aid and comfort to kit builders but charge for it. In 1984 he began inviting fellow helicoptarians to his house in Waynesville, Ohio. After three years, the July "copter meet" outgrew the neighborhood, and Bell bought a 200-acre farm, where he



NASM SI-74-2693

was more of a seminar back then," Bell says. "They'd bring their machines and we'd critique 'em. We'd help on certain things, like building up blades." Because today's kit-builders have much more help available—online forums, factory check-outs, paid builder assistance, aftermarket parts, DVDs, shrink-wrapped parts—and more components like rotor blades are sold already fabricated, needing only attachments, few helicopters pull up at Bell's door in dishabille anymore. "Every night the Helicycle guys go to their site on Yahoo," says John Murphy, who owns a one-seat Eagle R&D Helicycle. "Minutes after somebody has a problem, it's on the pilots' site." Users then respond with a solution or start a fix-it discussion. "So that gives you a warm fuzzy feeling."

Finishing a helicopter both completes

In the 1950s and beyond, Igor Bensen (at controls) offered various gyro-copter kits. He donated his B-8M to the Smithsonian in 1969 (left). Below: Three little Helicycles, all in a row. "We had just flown to a deli with great sandwiches," says photographer Joe Loxterkamp.



lives today, raising corn and soybeans, and putting aside helicoptering for the harvest each fall.

In the first years, Bell's fly-in was more of a drive-in, in which he hosted unflyable helicopters that arrived on trailers. Some of those that looked ready to go had owners who were reluctant to make the first flight without a nose-to-tail rotor inspection by Bell and other veterans. "It

a challenge and begins another. Let's assume that the new two-seater is rigged and balanced perfectly. Assume also that a certified flight instructor is on hand. Even so, the first days of practice are likely to be frustrating—even scary—because it takes time to develop the reflexes and multi-tasking skills unique to helicopter piloting. Once skids depart ground, pilots must make constant, small corrections on



SERGEY RYABTSEV

the controls without delay. Early kit-built rotorcraft had such a high crash rate that an FAA inspector in a July 1970 *Popular Science* article called them “the most dangerous type of experimental aircraft in use today,” and warned that 95 percent of the crashes happen at low speeds near the ground. It was a sobering change in tone from that found in earlier magazine articles. One reason for trouble among novices is the phenomenon called dynamic rollover. If a helicopter pivots around a landing gear during liftoff or one landing gear makes inadvertent contact with the ground while sliding sideways, the thrust of the main rotor will flip the machine on its side, requiring thousands of dollars in repairs.

The major brands of kit helicopters share the layout of Igor Sikorsky’s classic VS-300 prototype of 1941, which combined a single main rotor for lift with a small, vertically mounted rotor on a tailboom to offset the main rotor’s torque. Flight controls on kit-built helicopters mimic those on their production counterparts. Two “anti-torque” foot pedals control the pitch of the tail rotor and point the nose left or right; a collective lever connects to the main rotor and urges the machine up or down; and a joystick at knee level called a cyclic adjusts the main rotor to tilt the helicopter so it flutters off in the desired direction.

Orv Neisingh is an independent Missouri-based expert who has been training pilots on RotorWay helicopters for 10 years, and now holds an airframe-and-powerplant license that allows him to sign off on repair work during his field visits. That elevates him to one of an elite corps of consultants. Liability concerns,

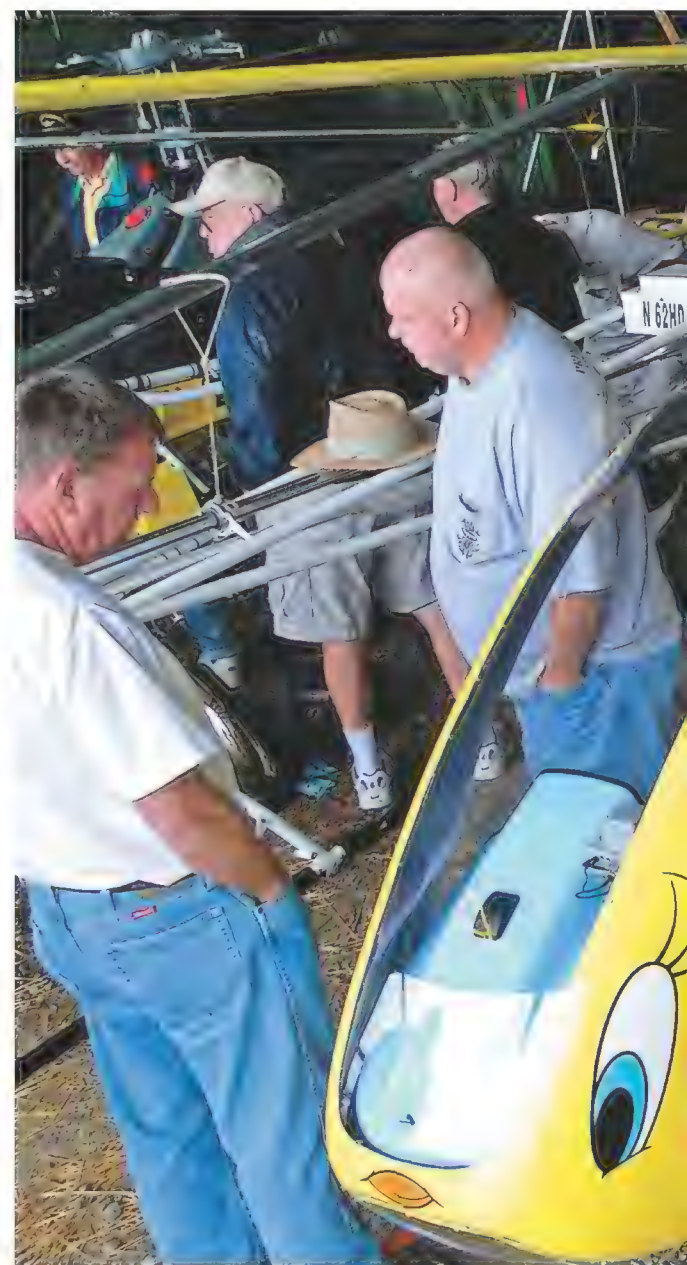


Introduced in 1991, Vertical Aviation Technologies’ Hummingbird (top) has an airframe derived from the Sikorsky S-52. Right: At Homer Bell’s annual fly-in (at his ranch, above), pilots swap hangar tales as they wait out the rain.

the small size of the kit-copter market, and the inclination among builders to perform their own repairs keep the number of licensed mechanics who deal with kit-built helicopters low. Neisingh’s service comes with a wise skepticism. Before scheduling work where he would fly another’s kit helicopter for training or testing, he requires the new customer to fill out a long and sobering checklist.

RotorWay customers can also go straight to the factory. RotorWay runs its flight school out of Stellar Airpark in Chandler, Arizona, in three sets, or phases, of classes. Each phase takes up to a week. Phase 1 is mainly for hover practice, which alternates with school on documentation, maintenance, and rigging. According to Robin Wactler, director of the flight school, the best time to come for Phase 1 training is near the end of construction, but before the main rotor is complete.

Nearing the end of their build, Helicycle owners are required to spend a week with an Eagle R&D representative like Doug Schwochert of Burlington, Wisconsin. Schwochert’s house call comes at an extra charge but it isn’t optional, since he brings a crucial pair of main-rotor bearings available only from the factory. (After B.J. Schramm liquidated his interest in



RotorWay and founded Eagle R&D, it was Schwochert who convinced him that a turbine instead of a piston engine should be the Helicycle’s standard powerplant.) Schwochert inspects each part before lighting off the turbine, followed by a series of adjustments before test flights begin.

A refurbished Solar T62 gas turbine once used in generators is the standard engine, accounting for a quarter of the kit’s \$39,800 price. Its power section spins at 62,000 rpm, more than 1,000 times a second. Gearboxes bring this down by a factor of 20 to suit the tail rotor, and still further for the main rotor. Though the Solar is rated for 160 shaft horsepower, Eagle has cut fuel flow, holding it to 90 shaft hp for longer life.

IT'S JUST AFTER LUNCH in the RotorWay school hangar, and the talk is of grease: the red variety, in a big shiny grease gun, and where to point it. A RotorWay 162F Executive (superseded by the A600 Talon in 2007) has grease points under the main rotor and around the tail rotor drives. Explains Robert Preston, the company's factory instructor pilot, owners

RotorWay-specific techniques.

Pool is a high-time corporate jet pilot (and licensed airframe-and-powerplant mechanic) who seems content with setting aside time and money to learn the hobby—up to a point: He wants to earn his hover endorsement this week, rather than having to come back later to finish Phase 1. Preston warns him that most stu-

dents need to come back for an additional week of training before moving on to Phases 2 and 3. In all, someone new to helicoptering could require four trips to Chandler, but at the end he or she will have a gilt-edged rotorcraft license.

Patience and good workmanship is key, says Al Behuncik. "The helicopter is a wonderful machine, but if it's not built correctly it can and will kill you. There's no excuse for anyone building a shoddy machine, because the instructional books and videos show you exactly how to do it."

What do people do with their helicopters upon completion, besides attend fly-ins? As these are experimental craft, commercial use is prohibited. Rod Harms plans on using his Talon for two-hour jaunts to Chicago, packing luggage in a cargo compartment that fits under the cabin. Joe Goetz uses his Helicycle as a volunteer eye in the sky for the sheriff's department in Maricopa County, Arizona; he enjoys the sense of mission and the fact that when on duty he can land at places otherwise off-limits to helicopters, like downtown parking ramps. Norm St. Peter and his wife use their float-equipped Hummingbird to fly from Florida to northern Maine, where they fish remote lakes.

Checking back with Don Pool at the end of his week at RotorWay, I learn he has beaten the odds and won his hovering endorsement. This opens the way for training at home, followed by more work at Chandler to finish his rating. Then he plans to load his Executive on a trailer and haul it out west behind an RV. Where the pavement stops and the desert begins, he'll climb in and head for the hills. 



A RotorWay Talon (right) served as a backdrop for a team reporting on a sports event in Holland in June 2009.

will be wielding the gun every 25 hours of routine operation, and will be checking air and fuel filters, changing oil, and tightening the chain drive and the three rubber belts that drive the tail rotor.

When explaining how to tighten bolts, Preston advises student Don Pool: "Remember, this is an aluminum block and steel wins every time, so don't apply more torque on the bolts than necessary—no monkey strength allowed!" With time out for flight training, Preston spends the week shouldering through a long list of



HUUB LEIENVELD/CINEVIDEOGROUP



THE BEST PLACE TO WATCH JOHN MOHR FLY his Stearman would have been up against the airshow fence, where I could have heard the crowd's gasps when the airplane, which had disappeared behind trees, suddenly reappeared in a vertical climb.

Instead, I was taxiing across the ramp because my performance was after his, but I did put on the brakes when an excruciatingly slow roll near the ground caused his engine to quit and flames to shoot out of his exhaust stack and down the side of his fabric fuselage. Even though I knew it was all part of the act, I still held my breath.

I was amazed by how Mohr could squeeze square loops and double snap rolls out of an underpowered, drag-ridden, 2,400-pound biplane at an airport with an elevation above 3,000 feet. The Stearman seemed to defy the aerodynamic laws of drag and air density as it flowed from one maneuver to another without the panting you'd expect from a heavy airplane on a hot August day.

The 220-horsepower PT-17 Kaydet, a

classic that Boeing manufactured between 1940 and 1944 (Mohr's was built in 1943), was designed as a primary military trainer for the basics: takeoffs, landings, climbs, glides, and elementary aerobatics. That is what a Stearman, ordinarily, still does: the basics. However, watching Mohr, I could see a flying dimension beyond the world where most pilots fly. It is a world in which finesse, intuition, and daring allow the more gifted pilots to do seemingly impossible things with an airplane like a stock Stearman. On its last pass the airplane looked like a cock-eyed crab, scooting sideways down the show line in the direction of its lowered left wingtip. Jerry Van Kempen, of Alexandria, Minnesota, knows Stearmans and the pilots who fly them, having spent 18 years as the Red Baron



Barnstorming *in the* Blood

One of the world's most inventive pilots makes everything old look new again.





Stearman squadron's announcer. He says, "John Mohr is the best Stearman driver in the world."

Mohr was born into a flying family and lived on Crane Lake at the northern Minnesota border. He grew up in the family airplanes, on floats and skis. His first solo flight was in their float-equipped J-3 Cub. As he heard the echo of his father's float-plane taking off each morning loaded with campers, hunters, or fishermen bound for nearby canoe and wilderness areas, his grandfather told him flying stories: about the SPAD he brought back in a crate from France and transformed into a parasol-style monoplane, about the Curtiss Jenny he learned to fly after World War I, and about barnstorming southern Minnesota and Iowa with a Waco 10.

When Mohr was 17, he built his first of

three kit helicopters, a single-seat Scorpion. It came with flying instructions, and following them, he taught himself to fly it. When he was 19 or 20, he bought a 145-hp Cessna 172 and converted it to a float-plane, but the black-and-white photos of biplanes on his grandfather's walls called him back to the Golden Age. So three years later, in 1975, he bought a Stearman and restored it to its original Army Air Corps yellow and blue.

"At Oshkosh I had seen the guys in the big biplanes with all their noise and smoke. Walt Pierce, Jimmy Franklin, and Bob Lyjak with his taper-wing Waco and his double snap, right on takeoff. They really impressed me," says Mohr. "I wanted a big biplane and I wanted to fly like they did."

With the Stearman, he was ready to begin his own brand of barnstorming.

On his signature final pass in his 1943 Stearman, John Mohr (opposite) shows what sets him apart from the rest.

A close friend scoped out fairs, festivals, and farmers' pastures in northeastern Minnesota where Mohr could sell rides on the weekends. "He'd get the people in and I'd climb up to a couple thousand feet," Mohr says. "I would do a loop, barrel roll, hammerhead, and snap roll, then would spin back down on a ride that lasted all of three minutes or so. Everybody would get out smiling, cheering, and laughing, and the next one would be ready to jump in. Nobody wanted a straight-and-level ride once the fun started. That is how I got good at acro." He was having fun, and making more money than he earned in the flight operation he had back in Orr, Minnesota,



When Mohr isn't performing, he might be found in his Piaggio Royal Gull, a rare, vintage amphibian.

where he also had a wife and a new baby. "During the week I was starving," Mohr recalls, "doing flight instruction, generating charter business, and trying to get hired by the airlines." By the time he landed a job at North Central Airlines, he had gained local fame and teamed up with nearby pilots to fly airshows. Today he is a captain for a major airline, but ever since those days of selling hops in his Stearman, Mohr has been a steady airshow performer.

"Once, at a show up in Longville," recalls Jerry Van Kempen, "the clouds were so low the ducks were walking and people were ready to leave, but after a while we heard the *blub, blub, blub* of John's 220 [horsepower engine] headed our way. He has never missed an airshow."

While he developed his Stearman routine, Mohr worked with a friend, Dave Simonson, to invent another startling act. Airshow

performers were doing only car-or-motorcycle-to-airplane transfers. When Mohr and Simonson tried an aerial transfer they saw why. Even in still air, a stuntman dangling on a rope ladder from a J-3 Cub swung dangerously close to the high arc of the Stearman's propeller. Then one day in 1993, while flying his Enstrom helicopter beside the Stearman, he wondered how close he could get to the airplane without causing a midair collision. "I started messing around with my approach angle until I finally found the sweet spot where I could approach the airplane and actually put a skid on the top wing. Suddenly I thought, *Wow, this is the transfer act!*" After some experimenting, they became comfortable enough with the flying to ask another friend, Royce Baar, to join them as the stuntman who grabs the helicopter skid and is lifted from the airplane.



Clockwise from top: Mohr started young, in a flying family. His pilot dad instructed him until he was ready for the J-3 Cub, bought in 1946 by his grandfather.



Mohr didn't know, and neither did Simonson, that eight or 10 years earlier, Hollywood pilot Craig Hosking had landed a helicopter on a DC-3 wing for the TV show "Incredible Sunday." When the pair started performing the transfer, they became the first to turn an airplane-helicopter transfer into an airshow act.

Mohr pitched the routine at the International Council of Air Shows annual convention, where airshow promoters shop for new acts. Most people looked at the video, shook their heads and said, "If you're still around in two years, *maybe* we'll consider you." But they got several bookings for the 1994 season, and gradually they became the rage. In 2000, Mohr Barnstorming won two national prizes: the Bill Barber Award for Showmanship and the Art Scholl Showmanship Award. By then Mohr had gained international attention for his solo Stearman act, which he says is the more challenging to fly.

All but a small portion of Mohr's performance is flown close to the ground, the tops of his looping-type maneuvers reaching no more than 400 or 500 feet. His flying margins are narrow; he relies on his skill, experience, and something called ground effect. During flight, wingtip vortices and the resulting downwash produce drag; when an airplane is no more than a wingspan away from the surface, the ground partially dissipates the vortices, reducing drag and boosting airspeed.

Probably no one is more impressed by Mohr's flying than other Stearman owners, and sometimes they refuse to believe that his airplane is a 100 percent stock machine. Recently at the Sun 'n Fun fly-in at Lakeland, Florida, a new Stearman owner questioned him over and over. "I watched you fly in this and you didn't climb for altitude," the man said. "You did a slow roll and a snap roll right on takeoff, then a hammerhead. My plane won't do that. What have you done to get that kind of performance?"

"Nothing," Mohr said. "I





have 10,000 hours in the airplane. It's skill and experience. It's not the airplane."

This is Mohr's trademark. What started as necessity—he couldn't afford more power to begin with—became virtuosity. He had to learn, he says, to fly the wing,

While perfecting an aerial transfer act (above), Mohr also test flew restored aircraft, like the 1936 Fleetwings Seabird.

not the engine. "Nobody else gets as much out of a 220-hp Stearman as I do," he says. "Even guys with 450s are flying higher and don't do as many maneuvers or put their shows together the way I do."

It is easy to see why fans expect a showplane to be modified. Many show pilots spend huge amounts of money to get more performance. In the past, prominent Stearman show pilots, such

as Joe Hughes and the Red Baron Squadron, doubled and tripled their engines' output for wingwalking and formation acts. They added streamlined cowlings, nose cones to cover the propeller hubs, fairings on wheels, and ailerons to their top wings to boost roll rate. The stock Stearman has none of this. With all its wires, struts, knobby tires, prominent exhaust pipe, and seven cylinders sticking out in the wind, it is as streamlined as a pine cone.

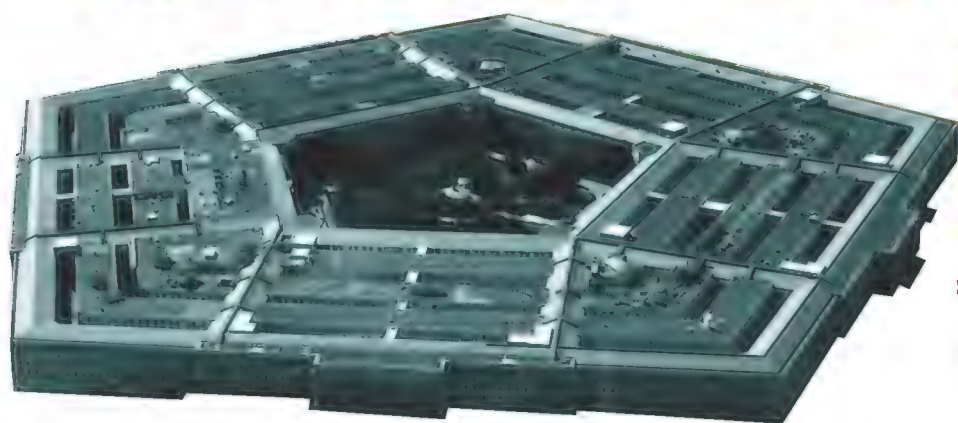
Mohr stopped flying the airplane-to-helicopter transfer act after about eight years because crew, maintenance, and insurance became prohibitively expensive. A few years ago, he revived it, partnering with Roger Buis, who flies the "OTTO The Helicopter" comedy act, and longtime stuntman Todd Green. The three of them ham it up, dance around, fly side-by-side hammerheads with Green hanging by his elbow from Otto's landing skid until Buis lowers him into a cloud of smoke on the ground.

A barnstormer's grandson, Mohr grew up thinking of new ways to fly old airplanes. He's still thinking, and developing the next act, which for now he is keeping behind his own smoke screen. —



ABOVE: RICHARD VANDERMEULEN; RIGHT: COURTESY, JOHN MOHR

HOW TO WIN ENEMIES AND INFLUENCE POLICY



FROM THE HALLS OF POWER
TO FIELD LABORATORIES, THE

AIR FORCE CHIEF SCIENTIST HELPS SHAPE THE FUTURE OF U.S. FLIGHT.



BY MARK WOLVERTON

SHORTLY AFTER starting his new job as Chief Scientist of the Air Force in the summer of 1973, Michael Yarymovych was at the Pentagon, attending a Department of Defense acquisitions meeting for satellite-based navigation—what is now known as the Global Positioning System. The meeting wasn't going very well.

Ideas for satellite-based navigation had been in development since the 1960s, but the Navy and the Air Force fought over technical details and which service should control it. When the Air Force was named the lead for the Defense Navigation Satellite System, the Navy began dragging its feet, insisting that its own version, Timation, was better.

As the Air Force colonel in charge of the DNSS program was making his presentation, Yarymovych says, “a Navy admiral stood up and said, ‘Listen sonny, we’ve been navigating the seas for the last 3,000 years, and I really don’t care to know the difference between the bow

and stern of my ship. Just place me on the surface of the ocean.’” The meeting fell apart and the program appeared dead.

But Yarymovych knew the idea of space-based navigation was beautiful; it just wasn't being sold right. He went to his boss, Air Force Chief of Staff General John D. Ryan, and got another chance to get things going. Yarymovych began forging compromises among the Air Force, Army, and Navy, putting together the best pieces from all quarters. One of his tactics involved changing the name of the system, with help from Colonel Brad Parkinson, who headed up the Air Force's DNSS proposal. “The Air Force

was in the middle of Vietnam: they were in no mood to think of fancy new space programs,” says Yarymovych. In a fighter pilot culture focused on pointy jets and dogfights, “satellite was a bad word, so I said, ‘Why call it satellite? You have LORAN, you don’t call it an antenna. It gives your position any place on the globe, right? So it’s a global positioning system.’ And it stuck.”

The Chief Scientist of the Air Force is

Top to bottom: Hap Arnold, Mark Lewis, and Michael Yarymovych have all played parts in the ongoing story of the Chief Scientist, a major role at the Pentagon.

a uniquely influential position. It is a temporary appointment for an accomplished civilian scientist or engineer, from academia or industry, to advise the Air Force on science and technology programs, clearly including selling them. He (no woman has yet served) works directly under the Secretary of the Air Force and the Chief of Staff and carries the authority of a three-star general, but wields no actual power, makes no decisions, controls no budget, and commands a staff of only two: a military assistant and an executive secretary.

It took a couple of visionaries to realize that the Air Force needs scientific advice and to create a position that supplies it. Theodore von Kármán, a leading engineer and physicist of the 20th century, was a Hungarian émigré who in 1930 had become director of the Guggenheim Aeronautical Laboratory of the California Institute of Technology (GALCIT), where he did pioneering research in aeronautics and rocketry. In 1944, he founded the Jet Propulsion Laboratory in Pasadena. General H. "Hap" Arnold, who had learned to fly at the Wright brothers' school and who became the commander of the Army Air Forces, saw building for the future as his life's work. When America was swept into World War II, Arnold was dismayed to discover that in aeronautical technology, the United States was trailing not only its enemies but even its allies. When America's test jet fighter, the Bell XP-59A, took off in 1942, it was powered by copies of a British-designed engine.

"That shocked Arnold," says aviation historian Richard Hallion. "He never again wanted to see the Army Air Forces dependent for its scientific advice on an outside organization."

In September 1944, Arnold summoned von Kármán to a meeting, where the general explained that although he was confident that the Allies had won the current war, he was worried about

the next: With the advent of jet propulsion, radar, and missiles, what was air power's future? He tasked von Kármán to gather a team of experts to chart a course. The report that resulted, *Toward New Horizons*, extrapolated scientific and technological progress decades ahead, with specific recommendations on how the Air Force could strengthen its research and development capabilities and on the use of technical advances.

But when Arnold retired in 1946, von Kármán lost his strongest advocate. The following year, the Air Force became an independent service under General Carl Spaatz, who didn't share Arnold's enthusiasm for science. Historian Dwayne Day notes in his book *Lightning Rod: A History of the Air Force Chief Scientist's Office*: "Although the Air Force enthusiastically endorsed the *idea* of accepting scientific advice and guidance, top Air Force officers were often unwilling to accept much of the advice, particularly if it conflicted with the service's current modes of operation and its cultural identity." In particular, the Air Force was advised to look into ballistic missiles, but the old-school bomber pilots running the show considered missiles and

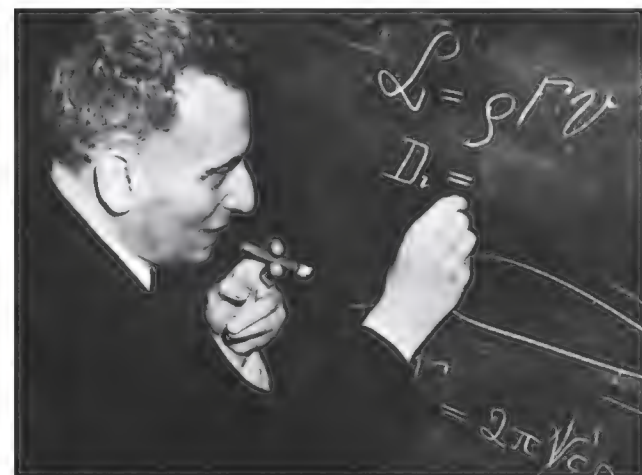
rockets the stuff of Buck Rogers—and missiles and rockets didn't need pilots.

Von Kármán approached General Hoyt Vandenberg, who in 1948 had succeeded Spaatz as Chief of Staff, and pointed out what World War II had amply demonstrated: Wars could be won with science. In *Toward New Horizons*, von Kármán had recommended a Scientific Advisory Board to advise the Air Force hierarchy, and the service had agreed. Vandenberg assigned the board to form a committee to evaluate how best to integrate scientific research and development into the Air Force. The committee, chaired by physicist Louis Ridenour of the Massachusetts Institute of Technology and the University of Illinois, produced a report that criticized the majority of the Air Force for a lack of interest in science and technology, among other things, and recommended the es-

At Dyess Air Force Base in Texas, Chief Scientist Werner Dahm (in flightsuit) preps for a ride in a B-1 bomber in September 2009. Six months later, he flew again, this time to evaluate the cockpit: Was there room for a laser beam operator?



SENIOR AIRMAN JENNIFER ROMIG/USAF



In turn, von Kármán argued the importance of technology to Hoyt Vandenberg, who in 1949 was named Air Force Chief of Staff (below, left, taking the oath of office), replacing Carl Spaatz, who had little interest in science.

[general], they never talk to the chief and the secretary. They only talk to the level above them.”

Chief Scientists have ranged from aerodynamicists and aeronautical engineers to physicists, computer scientists, mechanical engineers, and even a physiologist. “You have to find people who are polymaths, who have a tremendous sense of scientific and technical curiosity,” says Hallion.

An aeronautical engineer with an intense interest in spaceflight, Mike Yarymovych had worked for NASA on the Apollo program and had served as NASA’s representative to the Air Force’s Manned Orbiting Laboratory. He was asked to become Chief Scientist in 1973. “In the second year I ran a study using the old von Kármán name; I called it *New Horizons II*.” The study predicted that space would increase in importance as an arena for both civilian and military activities, and that computers would keep getting smaller and more ubiquitous. “At that time we were still dealing with IBM 650s—huge machines—and we’re saying, ‘We’re going to have several computers on each wing of an airplane,’ ” Yarymovych says. “The thought of miniaturizing processors and sticking them all over the place was kind of radical.”

Yarymovych’s prediction that the Air Force was entering “the age of computational plenty” wasn’t exactly welcomed. “At that time [it was] so revolutionary that it got [semi-]classified and put away because it was going to shake up a lot of

Concerned about the future of air power after World War II, Hap Arnold (above, second from left, inspecting ice formation on propeller) enlisted physicist Theodore von Kármán (above, right) to guide Air Force research.

first concerns. Along with colleague Ivan Getting (who had earlier turned down Saville’s request to advise him on science issues), Ridenour pushed for establishing the Lincoln Laboratory, a research center for air defense, at MIT. He was also instrumental in instituting a series of seminars at MIT that brought together top scientists and strategists and in which projects such as the Distant Early Warning Line and the Semiautomatic Ground Environment (SAGE) air defense computing and relay system were conceived.

Dan Hastings, an MIT physicist, served as Chief Scientist in the late 1990s. One of his first big projects was “Doable Space,” which recommended a greater reliance on commercial launches. As Chief Scientist, “you have authority over nothing,” he says, “but you have a great deal of influence, which stems from the fact that it’s a direct reporting relationship to the Chief and the Secretary. In a hierarchical organization like the military, the fact that you talk directly to the Chief and the Secretary means a great deal. You realize the average colonel and even the average one-star or two-star

establishment of a Deputy Chief of Staff for Development and the Air Research and Development Command.

One suggestion of the Ridenour report was that the Air Force hire leading scientists to serve as advisors for one or two years. In May 1950, the new Deputy Chief of Staff for Development, Major General Gordon Saville, asked Ridenour himself if he would be interested in such a position. In September, Ridenour was appointed Chief Scientist.

The cold war had just warmed up in Korea, the Soviet Union had built an atomic bomb, and America was struggling with the question of building an H-bomb and intercontinental ballistic missiles. The defense of North America from air attack was one of Ridenour’s



"THE AIR FORCE WAS IN THE MIDDLE OF VIETNAM: THEY WERE IN NO MOOD TO THINK OF FANCY SPACE PROGRAMS." IN A FIGHTER PILOT CULTURE FOCUSED ON POINTY JETS AND DOGFIGHTS, "SATELLITE WAS A BAD WORD, SO I SAID, 'WHY CALL IT SATELLITE? YOU HAVE LORAN, YOU DON'T CALL IT AN ANTENNA. IT GIVES YOUR POSITION ANY PLACE ON THE GLOBE, RIGHT? SO IT'S A GLOBAL POSITIONING SYSTEM.' AND IT STUCK."

things," he says. "It finally got declassified 20 years later." But there was still an indirect effect. A debate was flaring in the Pentagon over new fighter aircraft, specifically their designs and missions. "The discussion was the so-called high-low mix of fighters," says Yarymovych. "The [air superiority] F-15 was already being built, so the thought was 'How do you justify the [fighter-bomber] F-16?' Going back to my *New Horizons* study—when I said computers everywhere and small is beautiful, never mind the big things—they used that as one of the reasons to justify a smaller airplane."

The many issues on which the Chief Scientist has provided counsel reads like a history of Air Force technology. Examples and associated individuals include the development of supersonic aircraft (Horton Stever, Courtland D. Perkins), the integration of ballistic missiles into military strategy (George Valley), the rise and fall of the supersonic bomber (Joseph Charyk), increasing reliance on satellites and human spaceflight (Yarymovych and pretty much every Chief Scientist since Sputnik), remotely piloted vehicles (John Fisher, George Abrahamson), and directed-energy weapons (Dan Hastings). The Chief Scientist helped acquaint Air Force leadership with the potential of each new technology, easing its transition from the laboratory to the operational world.

Occasionally the Chief Scientist serves the opposite function: preventing the Air Force from squandering its budget on impractical ideas. "One of

my biggest challenges was reeling them back sometimes," says hypersonics expert Mark Lewis of the University of Maryland, who served as Chief Scientist from 2004 to 2008. "Someone would get a briefing on some latest or greatest technology and say, 'Wow, we got to do this,' and I'd have to say, 'That briefing looked good, but let's dig into this a little more.' One of the first issues [during Lewis' years] was a lot of interest in really high altitude. Some of the near-space solutions involved the use of airships. There

are things that airships can do very well. There are things that airships can't do very well, and one of those is flying at extraordinarily high altitudes and holding your position over a single spot on the Earth. And yet we had folks with viewgraphs where they'd imagine these mag-

Below: Michael Yarymovych, Chief Scientist 1973-75, helped get the Global Positioning System off the ground; left: Air Force sergeants set up a GPS base station antenna to map Tallil Air Base in Iraq in 2003. Bottom: Yarymovych's prediction that miniature computers would revolutionize flight technology was realized in the General Dynamics F-16, here refueling during a 1979 exercise.



TOP LEFT: SSGT CHENZIRA MALLORY/USAF; TOP RIGHT: COURTESY SETI LEAGUE; BOTTOM: SSGT JAMES R. PEARSON/USAF

BEING THE NAYSAYER IS A BIG PART OF BEING CHIEF SCIENTIST, SAYS LEWIS. "YOU'RE THE GUY TELLING PEOPLE THAT THEIR BABY IS UGLY, THAT THEIR CONCEPT DOESN'T WORK, AND SOMETIMES YOU HAVE TO TELL THEM WHY THEIR CONCEPT VIOLATES THE BASIC LAWS OF PHYSICS. NOT ALWAYS A POPULAR POSITION TO MAINTAIN."

ical airships that were hovering at some incredible altitude over some fixed point on the Earth for long duration."

Actually, says Lewis, being the naysayer is a big part of being Chief Scientist: "You're the guy telling people that their baby is ugly, that their concept

doesn't work, and sometimes you have to tell them why their concept violates the basic laws of physics. Not always a popular position to maintain." In fact, the Chief of Staff once told Lewis that "if people aren't calling and complaining about you, you're not doing your job."

He recalls the design of control stations for unmanned aerial vehicles. "Some of these weren't very ergonomic. Instead of being designed to look like a cockpit, the control stations were menu-driven, the way a home computer operates. In most cases, this is a poor way to



The Distant Early Warning Line – radar stations running across the far northern Arctic region of Canada (left) – and the Semi-Automated Ground Environment defense computer system (below: the intercept monitor room at the SAGE Direction Center) were conceived at seminars established by the first Chief Scientist, Louis Ridenour, in the early 1950s.



TOP: TSgt DONALD L. WETTERMAN/DOD; BOTTOM: MIT/LINCOLN LABORATORY

control an airplane. I brought this to the Chief and Secretary, along with the candid observation that the Air Force organization in charge of procuring our control stations was not doing enough to improve them."

The Chief of Staff at the time, General Michael Moseley, was an ex-fighter pilot who immediately saw the advantages of Lewis' suggestions and implemented the changes. Still, the Chief Scientist had stepped on a few toes, most notably those of the general who was in charge of the UAV control station project. "I learned a new four-letter word from that very upset general," Lewis observes wryly. (The Chief of Staff later told Lewis, "Partner, it's always good to expand your vocabulary.")

The Chief Scientist also deals with fairly mundane but no less important issues. Lewis, for example, mentions "sustainment": essentially, keeping the Air Force's aircraft and other assets up and running. "The average age of an airplane in the Air Force is about 26 years," he says. "Airplanes were literally falling apart in the sky." (In 2007, a National Guard F-15 had come

apart in flight, and when an investigation found that faulty longerons could cause fatigue cracks, the fleet was grounded.) "Keeping old airplanes flying, better diagnostic and repair techniques, ways of repairing old parts with newer parts, old materials with new materials, was an area that I focused on."

Lewis and his military assistant, Colonel Rob Fredell, also an engineer, looked into the use of new hybrid composite materials in aircraft. "One of these materials is called GLARE and combines glass fibers with thin aluminum slices," Lewis says. "The result is a material that is stronger and lighter than aluminum, but is very crack-resistant and has the repairability of aluminum. Repairing pure composites can be challenging." Lewis instituted a research effort on GLARE materials at the Air Force Research Laboratory



High-speed flight has long been of interest to Chief Scientists. Werner Dahm (left) shows off a painting of the ill-fated XB-70 supersonic bomber of the 1960s; hypersonics expert Mark Lewis – above, exiting an F-15 – championed hypersonic technology, which was demonstrated in a three-minute Mach 5 dash of the X-51A scramjet last May (preparations, top).

in partnership with contractors such as Lockheed Martin and Alcoa, proving the economic and engineering advantages of using such materials in transports and other aircraft.

The Chief Scientist is invariably on leave from a secure academic or industry position, is paid by the Pentagon at the same rate as that prior job, and serves knowing the old job will be there when his term is up. "It's not a launching pad to some other job in the Department of Defense," says Lewis, "which means that the Chief Scientist really isn't worried about the political consequences of telling the truth." Mike Yarmovych compares the job to that of a court jester: "You sit at the foot of the king's throne, and while the courtiers are telling him what he wants to hear, the court jester tells him the truth and

gets away with it without getting his head chopped off."

The biggest project for current Chief Scientist Werner Dahm is heading up a comprehensive study to define a science and technology vision for the next 20 years, much as von Kármán did in the 1940s. It's particularly critical now, says Dahm: "There are a lot of people who say, 'Gee, what a terrible time to be Chief Scientist,' because the budget looks miserable, and at some level that's true. But that's exactly when you have to make sure that you have clarity on where the highest-payoff science and technology investments are going to be. I'm having a great time." —

TOP: NASA DRYDEN; BOTTOM RIGHT: ROBINS AFB; BOTTOM LEFT: MASTER SGT STAN PARKER/USAF

The Classic Wagon

**WHY FAMILIES STILL
TRAVEL IN WACOS.**

BY JOHN FLEISCHMAN

PHOTOGRAPHS BY DON PARSONS



I LEFT MY HEART one summer day in the back seat of a 1934 Waco UKC. It was a “cabin” Waco, the classic biplane with an enclosed cockpit. It had red wheel pants too, and a Continental W670 220-horsepower engine. David Parsons was flying it last year at a fly-in at Wynkoop Airport, a private grass strip near the central Ohio town of Mount Vernon. For David, his wife Sally, and their children Abbie and Zach, the biplane is the perfect family conveyance for Sunday morning pancake hops or antique airplane reunions—rear bench seat, sea-green wool upholstery, wood-trimmed windows. Pushed aboard through the single side door, I was suddenly back in my Uncle Tom Kelly’s earthbound pride and joy, a 1947 Mercury, but with wings. The UKC bounded down the grass and up into a cloudless sky. We circled round the pattern, above



orderly rows of Wacos parked in a checkerboard of banana yellow, butter-milk cream, and watermelon red. There were the graceful, open-cockpit biplanes, especially straight- and taper-wing models that made Waco the epitome of Golden Age helmeted aviation. And there were the slightly boxy cabins of Standard and Custom models, the final word in 1930s private flying, with their roomy, heated interiors. In 1931, Waco converted to a system of three-letter codes denoting models by engine, wing style, and fuselage, an endless delight for the cognoscenti but near-total confusion for mere airplane lovers. Called the King of Biplanes, the youngest Wacos at this June 2009 fly-in would be eligible for Medicare, with many others near 80 years old.

I landed with two questions: What ever happened to Waco? And why are so many Wacos still flying, all these years

later? We may need pronunciation lessons in the 21st century—it’s not “Wake-o” or “Whack-o,” but “WAH-co,” to rhyme with “taco”—but in its heyday, from 1926 to the early years of World War II, Waco was a major brand, America’s leading manufacturer of small commercial airplanes.

For more than 25 years, Andy Heins, co-president of the National Waco Club, has been creating a database of every Waco built by the original manufacturer. The company moved twice before settling in Troy, Ohio, some 50 miles from Mount Vernon, and changed its name several times, once without any clear notation in the corporate minutes. It also wrote its name as both Waco and WACO. Today, the National Waco Club spells it lowercase, while the American WACO Club uses all caps. The American club, based at Creve Coeur Airport near St.



COURTESY OF ANDY HEINS

Carl Buck (opposite, seated) relaxes with friends while enjoying the shade of his Waco ZKS-6, built in 1936. He was one of some 50 owners to attend the National Waco Club fly-in at Mount Vernon, Ohio, in June 2009. In 1937, newly minted EGC-7s (left), sold to Brazil, sat outside the factory in Troy, Ohio.



Louis, Missouri, broke away from the National club in the early 1990s, largely over personality clashes that no one wants to dredge up. Many owners belong to both, and the president of the American club, Phil Coulson, is always welcome to fly his 1932 UBA to the National club's events. There is also a Western Waco Club in the San Francisco Bay area.

The Parsons family is something between a dynasty and a squadron. David's brother Doug is the National Waco Club's other co-president. Their dad, Lee, joined

us that day in Mount Vernon after flying from the family farm in eastern Ohio in the 1931 open-cockpit QCF he's owned for 48 years. After the 1973 oil crisis, Lee decided that the QCF had to earn its keep. Together, they hopped passengers at county fairs and towed banners over stadiums, until insurance premiums forced the QCF into retirement from commercial work. Maybe one reason so many Wacos are still around is that they function so well, like elderly family members who are still healthy and very much a part of the team. (Don Parsons, the photographer for this article, is not related.)

In the early days, one of Lee's first passengers in the open-front cockpit was his wife Donna, holding five-week-old Doug.

With a little Golden Age bravado, Tom Eggert of Woodbury, Minnesota, flies low in his 1937 Waco YKS-7, which can reach 145 mph and climb 1,000 feet per minute with a 275-horsepower engine.

Lee recalled, "The doctor said that we were going to expose him to all sorts of other things anyway, and that if we wrapped him up good, we could take him."

Doug seems to have suffered no harm. He had arrived in his 1934 YKC cabin with wife Trenna and kids Brandon and Brooke. And I met sister Dianna and her husband Randy Scott, a pilot, who'd been Doug's college roommate. Dianna never learned to fly. She and Randy are restoring a Stinson 108-2 Voyager. Stinson? The rest of the

Below, left to right: The factory in Troy, and women in its fabric shop, weathered the Depression. The Waco logo on a dew-streaked fuselage conveys staying power.



COURTESY OF ANDY HEINS



NASM (SI-2008-4153)



clan seemed remarkably tolerant.

Waco production was brisk and steady up through World War II, says Andy Heins. This excludes the 14,000 troop-carrying CG-4A gliders, designed by Waco and cranked out during World War II by a variety of manufacturers. After 1942, the company never produced another powered aircraft, save for a prototype dud that first flew in 1947. Military gliders aside, Heins calculates that between 1920 and 1946, Waco made about 4,150 airplanes,

give or take five percent (he says that good records were not kept prior to 1928). Going through Federal Aviation Administration registration certificates, he's found 756 Wacos still listed and estimates that fewer than 300 are flyable. Some exist only on paper, with no parts. Some are "lost" in barns and basements, in parts but without papers. Leaving out foreign-registered Wacos (Heins knows of at least 35) and those hanging on wires in museums, this means that about 18 percent of all the

airplanes ever made are still around, with maybe seven percent of the original 4,150 still flying. Compare that to your average 70-year-old automobile—you won't find seven percent of many car production runs from 1940 on the road. It's a different story when you compare other biplanes from the era: Of the 8,584 Stearman Kaydets built between 1934 and 1944, and the equivalent of 2,000 more in spares, about 1,500 are still flying. And a few hundred Beech Model 17 Staggerwings are still in the skies, even though just 781 were built between the end of 1932 (the first flight) and 1949.



For the Parsons clan (left), Wacos are family too. Patriarch Lee (at right) has owned a QCF for almost half a century. Sons Doug (next to Lee) and David (back row, far left) own Wacos too: David's UKC (foreground) and Doug's YKC (at left). Below: A brood of Wacos at the fly-in.

IT ALL STARTED IN 1919 with two Michigan high school chums, Clayton Brukner and Elwood J. "Sam" Junkin, who worked briefly as mechanics for Aeromarine Plane and Motor Company in New Jersey and the Curtiss Aeroplane and Motor Corporation in New York. That year, with Harold Deuther, they started a company in Lorain, Ohio, called DBJ Aeroplane Company. Of three airplanes they made, just one, the DBJ Scout, got into the





Above, left to right: Phil Coulson, president of the American WACO Club, and wife Ruthie, with their UBA; Cliff Miller lands a patriotic UPF-7; the wood-paneled cockpit of Doug Parsons' YKC.



Morning light warms Tom Brown's QDC, which came to Wynkoop all the way from Unity, Wisconsin.

air. The two failed efforts were flying boats. Later that year, the three men joined with George "Buck" Weaver, and called themselves the Weaver Aircraft Company. By September 1, 1920, the company was incorporated, with the four men as its officers. They built a midget, high-wing monoplane they called the Cootie, which soon crashed, nearly killing Weaver. While he recovered, the others rebuilt the Cootie as a biplane. It never sold, and at the end of 1922, Weaver left the company. Moving to Troy, Ohio, a few months later, the company changed its name to the Advance Aircraft Company. There the men had their first success with the Waco 7, and sold 12. The Waco 9, with its airframe of welded steel tube, was their breakthrough design: They built 283 between 1925 and 1927. Starting in 1927, the Waco 10 became the

company's bestseller—1,232 through 1930. The 10 was sturdy, moderately priced, and forgiving of new pilots. In 1929, the company changed its name to simply the Waco Aircraft Company.

By then Deuther had left, and Junkin was dead. The company became the creature of Clayton Brukner, an industrial visionary who remained a closed book to all but his closest associates. He had business managers, marketing directors, and first rate aircraft designers, but it was he who ran the company in its pre-war glory, all the way to the end.

During the Depression, other companies such as Cessna had to shut their doors, but Waco flourished. By the mid-1930s, the company was selling a premium product at a premium price, and its slogan radiated confidence: "Ask Any Pilot." In 1937, a top-of-the-line EGC-7 with a 320-horsepower Wright radial, cabin heater and ventilator, wheel cuffs, ashtrays, dome light, and broadcloth upholstery listed for \$10,625 (a 1937 Chevro-

let cost \$620). The price climbed with wheel pants, custom paint, or a fancier propeller. An internal sales manual read, "While nobody can lay down precise and exact rules for selling an airplane, the study of human nature is even more important in aircraft selling than in other forms of merchandising."

People in the aviation business were overly friendly, the manual warned, and this was not the way to sell Wacos. "Too often this attitude of unrestraint and informality extends into your organization and the unusual friendliness that seems to be part of our industry reacts unfavorably in the eyes of your prospect, who is probably a man of some consequence...."

The men of some consequence who bought Wacos included Howard Hughes (aviation), Powel Crosley Jr. (radio), and Henry du Pont (chemical company heir). Because businessmen could fly a closed-cockpit Waco in business suits, cabins were the ancestors to corporate jets. Women of some consequence, too, bought and flew Wacos, including Jackie Cochran, who owned a 1933 UIC long before she commanded the wartime Women Airforce Service Pilots.

But one of Waco's best clients was Henry King, a Hollywood actor, director, and producer. King made more than 100 movies, from his first silent film in 1915 to his last Cinemascope production in 1962, including the ultimate World War II bomber film, *Twelve O'Clock High*. In 1933, he bought the first of what would be six Wacos—a UIC cabin, according to his son, John.

John King was apologetic about his

lack of recall of the UIC, as well as the next Waco his father bought in 1936 and kept for a year. Reached at his home near Charlottesville, Virginia, the retired mechanical engineer confesses that he was six years old in 1933. "I'm a little vague on some of this," he says. "I'm not sure what I've made up or what I was told when I was a kid." But he vividly recalls the experience of flying with his dad, and he especially remembers the C-40 model, with its huge R-985 engine.

His father's Wacos were magic carpets, whisking young John off to Palm Springs for lunch and back to Los Angeles for an afternoon swim at a Santa Monica beach club. "My older brother and I were kind of my dad's autopilot, as soon as we were big enough to see over the instrument panel and reach the pedals," he says. On a 1935 trip to Troy to pick up a propeller, John rode along while a Waco corporate test pilot made some speed runs. "They would just buzz right down the center of the Waco air strip at about 50 feet off the

ground with the throttle wide open. I don't know if they were timing it or what, but he did it about two or three times. I was in the back seat and thought it was great fun."

WHEN THE UNITED STATES entered World War II, luxury took a back seat too, even at Waco. For several years, the company churned out gliders of steel tube, plywood, and canvas, as well as P-47 engine mounts and bomb dollies. After the war, Waco made a weak effort to get back to luxury when it attempted to enter the high-wing monoplane market with the Aristocraft, which had an ungainly tail-mounted pusher prop. It never came close to production. Then suddenly, in 1947, Brukner announced that Waco was abandoning the airplane business to become a manufacturer of bread truck bodies, the Orbitan Sun Lamp, and the Lickety Log Splitter. The company was sold to Allied Industries around 1961, and closed in 1965. All Waco drawings, test

flight records, and engineering notes were donated to the Smithsonian Institution. Brukner, who had never married, developed a new passion: nature. In 1967, he turned over the 136 acres of wetlands he had purchased along the Stillwater River near Troy to the non-profit Brukner Nature Center.

By then, Waco lovers were pondering the legacy of the airplane. The National Waco Club had been founded in 1958 by five enthusiasts at Ottumwa, Iowa, and the first fly-in was held in 1959 at the South Dayton Airport in Ohio (now called Moraine Air Park). Ten Wacos made it.

The ringleader was Ray Brandly, an ex-B-17 pilot who in the mid-1950s took part ownership of a 1941 Waco UPF-7, an open-cockpit trainer, 600 of which had been sold to the Civilian Pilot Training

Terry Chastain dopes a Waco ATO at Creve Coeur Airport, near St. Louis. Patience is key for Waco buyers, as restorations can take a decade or more.





Terry Chastain flies a UBF-2 (top) and an ATO Taperwing (right). National Waco Club co-president Andy Heins (left) shares a laugh with Dick Jackson.

program. Throughout the 1950s, Brandly grew fascinated by Wacos while they spun out their days as charters, skywriters, and crop dusters. He discovered the old factory's stockpile of parts in Troy and approached Brukner, who, puzzled by interest in his obsolete airplane, agreed to sell Brandly what was left.

In later years, Brukner's puzzlement

only grew. He became a regular guest of honor at National Waco Club fly-ins before his death in 1977. Though he earned his pilot's license in 1928, by all accounts he had given up flying by the mid-1930s. Forty years later, the old man was flattered by all the fuss of the Waco revival.

That revival was fueled by Brandly, who died in 1996, according to Dick and Patsy Jackson of Rochester, New Hampshire. They own a rare-as-hen's-teeth 1934 S3HD, the only known survivor of Waco's efforts to market a military fighter. Jack-

son recalled his first visit to Brandly and his stash of Waco parts: "Ray had a barn full of wings and all sorts of stuff. That was 50 years ago and all that stuff is long gone." Pointing to the rows of restored Wacos at the Mount Vernon fly-in that day, Jackson added, "You're looking at a lot of it right now."

WACOS HAVE A WAY of running in families. A good example: Alan Buchner's 1932 QDC cabin. In 1972, Buchner discovered the QDC, wings removed, standing on its nose to save space in a Merced, Cal-

ifornia barn that housed farm equipment. It took three years and two owners before he got his hands on it, and another 15 to restore it. Two years into the project, he got the FAA paperwork, only to discover that his father, Les, had been the QDC's fifth owner, having bought it in 1938.

A Waco rebuild can run anywhere between \$150,000 and \$200,000, says Scott Shue, who restores them with his father John in Emigsville, Pennsylvania. John Shue bought his first Waco in 1964, when Scott was five. Scott helped rebuild the UPF-7, and soloed it on his 16th birthday. Between commercial restorations, they're in the midst of a complete rebuild of the family Waco. "Only two more years to go," says Scott.

Those without patience or a rebuildable Waco can order a new open-cockpit YMF-5 from the Waco Classic Aircraft Corporation of Battle Creek, Michigan. Built to the original Bureau of Air Commerce Type Certificate first issued in 1935, each new YMF-5 comes with "300 reliability and safety improvements," says the company, all of it starting at \$395,500. These new Wacos are among

How long will a 1929 CSO (foreground) go on flying? At least as long as there are new generations of Waco lovers.

the handful of Golden Age airplanes, such as the Great Lakes 2T-1A, that have gone back into production.

You don't have to own a Waco to love them. Doug Parsons estimates that a third of National Waco Club members don't have airplanes. Tom Woodburn, from Glen Allen, Virginia, is a club member still on foot, but he's been restoring his 1935 YOC cabin since 1999. He recently found replacements for Waco's no-longer-manufactured compression struts, which hold the wings up on the ground and down in flight. "I've still got a long way to go, but this is a major advance," says Woodburn, looking not the least bit discouraged. His wife Jane sat by his side in the refreshment tent, chatting with friends they've made in the two decades that they've been coming to fly-ins without a Waco. "Part of the joy is the search for parts," says Woodburn. "That's why an organization like this is so valuable. You tell people, 'Hey, here's what I'm looking for,' and someone will say, 'Oh, I know a fellow who has two of those.' I bet that conversation goes on about a hundred times a day here."

The Heins clan was there too. Father Ed Heins, who died in 1991, flew C-47s in North Africa and Europe during World War II and bought his first Waco, a 1941

UPF-7, in 1957. Ed passed his obsession to his sons, Mike, Pete, and Andy. Pete arrived in the hottest Waco of its day, the CRG National Air Tour racer, only two of which were built in 1930. Each evening, Pete skywrote "Waco" overhead.

Andy managed to increase the size of his flying family by marrying Susan Theodorelos, whom he met on the Internet but wooed with a Waco. "We never talked about the flying because normally that's the kiss of death for women," he says. But Theodorelos told him that her dad had been a Navy pilot. "I said, 'If you want to meet me, come down to the field.' I'm standing there on a ladder with oil all down my pants, surrounded by about seven 'supervisors' all drinking beer, when Susan turned up. She walked over to the plane and started asking me all sorts of questions. I look up and all my buddies are giving me the thumbs-up signal."

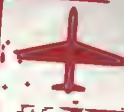
It was a relationship sealed with another Waco, an RNF open seater that Susan bought before she'd earned her pilot's license. The couple now owns four Wacos and a house filled with Waco drawings, paintings, photographs, ads, company Christmas cards, data plates, instrument dials, and a large wooden propeller leaning in a corner. —



CANCELLED

Some ideas just won't fly.

DC-X



Black Day at White Sands

McDonnell Douglas DC-X | BY PRESTON LERNER

THE DELTA CLIPPER, as the McDonnell Douglas single-stage-to-orbit vehicle was dubbed, was designed to take off and land vertically like the spacecraft in 1950s sci-fi flicks. Promoted as a cheap, uncomplicated vehicle that would make spaceflight affordable, the DC-X crashed and burned—literally—on its 12th flight, in 1996. John Logsdon, founder of George Washington University's Space Policy Institute, offers a postmortem analysis: "It wasn't strong enough to survive political reservations."

The project was the brainchild of Max Hunter, who in the 1960s had promoted nuclear-powered spacecraft as an alternative to expendable rockets. In 1989, Hunter, science fiction author Jerry Pournelle, and retired Army Lieutenant General Daniel O. Graham, an advocate of missile defense, pitched the program to Vice President Dan Quayle. With Quayle's backing, the project was funded by the Strategic Defense Initiative Organization, the agency running the missile defense program derisively nicknamed Star Wars.

Single-stage-to-orbit appeals to seekers of cheap access to space because in theory, it's far more efficient than the multi-stage rockets that dominate the launch industry. But the technology needed to make single-stage to orbit a reality didn't—and still doesn't—exist, so McDonnell Douglas focused on demonstrating that a small crew could launch a spacecraft with lightning-fast turnaround times and at low cost—as long as the system was kept simple.

Neither graceful nor imposing, the Delta Clipper looked like an elongated pyramid. On its first flight, at the White

Sands Missile Range in New Mexico in August 1993, mission control—a trailer—held a crew of seven, led by former Apollo astronaut Pete Conrad. At liftoff, the DC-X popped out of the smoke produced by four Pratt & Whitney RL10A-5 liquid-fuel rocket motors and rose to 150 feet. After hovering briefly, and still maintaining its nose-up attitude, it "translated," or moved sideways, 350 feet, propelled by gimbaled engines. Then, with the engines throttled

and with the cold war over, supporters found it increasingly difficult to carve money out of military budgets. The DC-X was transferred to NASA's Reusable Launch Vehicle program. On flight eight, a hard landing damaged the exterior "aeroshell," so the Delta Clipper was put on a crash diet to make single-stage-to-orbit more plausible.

The vehicle got lighter fuel tanks and an upgraded control system. The new and improved model was christened the DC-XA and dubbed the Clipper Graham, in honor of its early advocate, who died in 1995. The team returned to White Sands and embarked on a series of flight tests, highlighted by two launches within 26 hours of each other. On June 8, 1996, the DC-XA flew for 142 seconds and reached 10,332 feet. But on July 31, 1996, due to a maintenance glitch, one of the four landing struts failed to extend at touchdown. The vehicle tipped over and was consumed in a fire fueled by the liquid oxygen oxidizer.

There was no money left to repair Clipper Graham, and NASA preferred to pursue its own reusable launch idea, the Lockheed Martin X-33 VentureStar. More damning, the Clipper didn't fundamentally advance the science of spaceflight, leading critics to deride it as "single stage to nowhere." But Clipper fans may get the last laugh. Several DC-X engineers are involved in Blue Origin, the commercial space project funded by amazon.com's Jeff Bezos. And in recent years, Masten Space Systems and Armadillo Aerospace, two upstarts in the privatization of space, have demonstrated that the vertical-takeoff-and-landing approach works. ✈



The DC-X backs into its parking spot at White Sands in September 1993.

back to half power, the Delta Clipper descended slowly on a fiery plume and, 59 seconds after liftoff, landed on its tail.

By the end of September, the DC-X had made three flights. But the Delta Clipper was a political hot potato in Washington,



claroxan

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Brian Grote is a flight instructor with years aviation experience. He also writes monthly columns on subjects pertaining to aviation.

FLYBY

ARTICLE WRITTEN BY: BRIAN GROTE

Dear Brian,

I've been flying for over 20 years. My usual run is a Denver departure at 9pm, fly to Billings, on to Cheyenne and then back to Denver by 5am. I fly a King Air 350. I love my career and I pride myself on doing the best job I possibly can.

Last time out, however, I was making lots of little mistakes. I was cleared for the ILS Runway 35R into Denver, but I couldn't pick up ATIS. That's when I looked at my radios and noticed I had dialed in the wrong frequency. I glanced again and dialed in the right frequency. I continued through my checklist and set my Radar Altimeter to 5500 feet. I was ready to make my descent and start my approach. After the outer marker I glanced at my DH again and noticed that I had set my Radar Altimeter, 67 feet low. Luckily, I landed safely, bouncing the wheels just a little.

After a couple more days in the sky I could tell my eyesight was beginning to deteriorate. I knew I wouldn't be able to renew my first class medical if I didn't do anything about it. I was really worried and started asking my peers if there was anything I could do. A co-worker gave me a bottle of Claroxan™ and told me it would help me maintain my depth perception. I was skeptical at first, but tried it anyway. As it turns out, the stuff works great. The problem is, I ran out and don't know where to find more. Have you heard of this Claroxan™ stuff? Is it available in the States?

Jason, 46 – Seattle, WA

Jason,

Not only do I know of Claroxan™, it just so happens I take it everyday. Being a pilot myself, I know that perfect visual acuity is an asset none of us can afford to lose. That's why every pilot should be protecting their eyesight before it's too late.

Claroxan™ contains ingredients proven beneficial for the eyes. Among these ingredients are lutein and zeaxanthin – powerful antioxidants that have been clinically proven to protect the retina and macula and, in some cases, reverse the damaging effects of macular degeneration. These antioxidants block damaging UV rays and halt damaging free radical oxidation in the back of the eyes. They have also been clinically proven to decrease the risk of cataracts.

Claroxan™ also contains bilberry, an antioxidant known to improve night vision. Bilberry's night vision enhancing effects were first noticed in England in the early 1940's. The RAF ordered English fighter pilots to eat bilberry jam on toast figuring it would give them an advantage during night raid missions against the German Luftwaffe fighters.

Claroxan's unique proprietary formulation is completely safe, all-natural and extremely affordable. As far as ordering it, you can call them toll-free at 866.775.3937, or go to www.claroxan.com. I usually get mine within a week after ordering.

Hope this helps!
Brian

THE Himalayan CATARACT project

The Himalayan Cataract Project strives to eradicate preventable and curable blindness in the Himalayas through high-quality ophthalmic care, education, and establishment of a sustainable eye care infrastructure.

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Sunlight, aging, and diet each cause damage to the retina and macula, which can lead to a decline in vision that glasses or contacts can't help. If you've experienced an increase in blurriness or have difficulty seeing details at any range, then you know how valuable sharp vision can be. What you might not know is that in the past three years, a flood of new scientific research has been done on natural vision enhancement. This medical research suggests that ingredients in Claroxan™ may help maintain and even improve your vision, while at the same time giving you added protection against many ocular diseases.

Claroxan™ may improve macular pigment density, which research shows has amazing effects on vision. By improving macular pigment density, ingredients in Claroxan™ may improve normal

visual acuity, contrast sensitivity, and even glare reduction. Participants in one clinical study reported that ingredients in Claroxan™ improved their long range vision outdoors – in some cases, they were able to distinguish far away ridges up to 27 miles further than normal! Even if you have perfect vision now, Claroxan™ may help give you an edge by improving your visual reflexes and may allow you to pick up on moving objects faster than ever before.

People who count on their vision – people like pilots, hunters, military, and even pro athletes – trust Claroxan™ as the best source available for vision enhancement and protection. Claroxan™ is safe, effective, and extremely affordable. However, people with serious health concerns should consult a doctor before use.



Fill'er Up

WHEN AERIAL REFUELING began 90 years ago, it was self-serve. The first to gas up in mid-air was U.S. Navy Lieutenant Godfrey Cabot, who, while skimming the Potomac River in a Huff-Daland HD-4, used a grappling hook on the fuselage to snatch a five-gallon can of fuel from a float in October 1921.

Air-to-air, gravity-fed fueling came along two years later when Army Air Corps pilots at Rockwell Field in San Diego used one de Havilland DH-4B to refuel another via a 50-foot rubber hose. But in-flight gassing didn't become routine until the Korean War.

"I think of two eras: 30 years of stunts and experimentation, followed by 60 years of operational use," says Jim McCormick, who manages aerial refueling research for the Defense Advanced Research Projects Agency.

It was the need to station U.S. jet fighters in Korea and to give the

An Air Force EC-130H gasses up from a KC-135R tanker's boom while flying over the Colorado River in western Arizona.

Strategic Air Command's bombers the capacity to make non-stop round trips to the Soviet Union that drove the progress of aerial refueling. By late 1950, two devices had been developed to give the tanker's feed line stability in the airstream: a drogue, or basket, shaped like a shuttlecock, at the end of a fuel hose, and a telescoping boom. (The boom can feed fuel six times faster than a drogue and can do so at higher speeds and in worse weather.)

"The equipment and techniques have been improved to make in-flight refueling safer and more effective, but the systems have not changed radically," says McCormick. On Boeing KC-767 tankers, operators use advanced



Early aerial refueling required catching the hose by hand, as the back-seater in the de Havilland DH-4B (left) did in 1923.

consoles near the cockpit with remote controls and camera monitors that enable them to fly the booms more precisely in low visibility or darkness. Greater use of simulators during training is also making refueling safer.

Today, researchers are gauging the feasibility of refueling unmanned aircraft. The Air Force Research Laboratory and Boeing's Phantom Works are investigating boom technology with a manned KC-135R tanker and a Learjet modified to fly unmanned in tests set to run until 2013. Meanwhile, DARPA and NASA studied drogue systems using a pair of F/A-18As configured for pilot-less flight; those tests, which proved the viability of automated refueling, ended in 2007.

Next spring, DARPA plans to fly a Global Hawk UAV in the first high-altitude tests of one unmanned aircraft using a drogue to refuel another. McCormick predicts that any refinements in the technology will eventually be used in piloted aircraft.

ROGER A. MOLA



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"Well, I finally did it. I finally decided to enter the digital age and get a cell phone. My kids have been bugging me, my book group made fun of me, and the last straw was when my car broke down, and I was stuck by the highway for an hour before someone stopped to help. But when I went to the cell phone store, I almost changed my mind. The phones are so small I can't see the numbers, much less push the right one. They all have cameras, computers and a "global-positioning" something or other that's supposed to spot me from space. Goodness, all I want to do is to be able to talk to my grandkids! The people at the store weren't much help. They couldn't understand why someone wouldn't want a phone the size of a postage stamp. And the rate plans! They were complicated, confusing, and expensive... and the contract lasted for two years! I'd almost given up when a friend told me about her new Jitterbug phone. Now, I have the convenience and safety of being able to stay in touch... with a phone I can actually use."

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The cell phone that's right for me. Sometimes I think the people who designed this phone and the rate plans had me in mind. The phone fits easily in my pocket, but it flips open and reaches from my mouth to my ear. The display is large and backlit, so I can actually see who is calling. With a push of a button I can amplify the volume, and if I don't know a number, I can simply push one for a friendly, helpful operator that will look it up and even dial it for me. The Jitterbug also reduces background noise, making the sound loud and clear. There's even a dial tone, so I know the phone is ready to use.

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Reviews & Previews

BOOKS, MOVIES, CDs, STUFF TO BUY

The Unstoppables

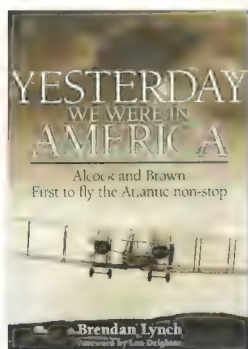
Cloudy skies, freezing rain, and mechanical trouble couldn't keep a pair of British fliers from crossing the Atlantic in an open-cockpit biplane.



Yesterday We Were in America: Alcock and Brown, First to Fly the Atlantic Non-Stop

by Brendan Lynch. Haynes, 2009. 256 pp., \$39.95.

IT WAS THE SPRING OF 1919. The airplane had proven itself as a weapon of war; now it needed to demonstrate peaceful abilities: bridging oceans and drawing the peoples of the world closer together. The Atlantic beckoned. The crewmen of the U.S. Navy's NC-4 flying boat were the first across, flying from Newfoundland, Canada, to Plymouth, England, via the Azores and Lisbon, on May 16 to 31. But the Navy




effort was quickly followed by a competition that would overshadow it: to become the first to cross the Atlantic nonstop.

As the NC-4 was winging its way toward Europe, four teams of British aviators gathered on the Canadian shore, poised to climb aboard their Sopwith, Martinsyde, Handley-Page, and Vickers aircraft and attempt to capture a £10,000 prize offered by English press baron Lord Northcliffe to the first airmen to cross the Atlantic in less than 72 hours. A pair of Royal Air Force veterans, John Alcock and Arthur Whitten Brown, captured the prize, flying their Vickers

John Alcock and Arthur Brown survived a not-so-pretty landing in an Irish bog.

Vimy 1,880 miles in 16 hours to a rough landing in an Irish bog on June 15.

In this fresh retelling of the familiar story, Brendan Lynch punctures one of the persistent myths surrounding the epic flight. Rather than having to leave the cockpit and clamber out on an icy wing to clear the face of a critically important gauge, Brown was able to accomplish the task simply by turning and standing up on his seat. In view of the sleet and freezing slipstream, that was quite heroic enough.

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>>> At a Glance <<<

The NASA Northrop T-38: Photographic Art From an Astronaut Pilot

by Story Musgrave. Lannistoria, 2009. 266 pp., \$49.95.

The author, a veteran of six space shuttle flights,



carried a camera on almost every flight in his NASA-issued T-38 trainer.

His book features 280 color photographs selected from the more than 15,000 that Musgrave captured of and from the airplane. (For an interview with Musgrave, see p. 11.)

Soviet Strategic Aviation in the Cold War

by Yefim Gordon. Hikoki Publications through specialtypress.com, 2009. 272 pp., \$56.95.

Yefim Gordon, who was born in the Soviet Union in 1950, chronicles Soviet

aircraft development for almost 50 years, up until the breakup of the Union in 1991. The book features 500 photographs (most of them previously unpublished in the West) of such



aircraft as the Tupolev Tu-160, which could carry 12 cruise missiles, and the gorgeously streamlined Tu-22, the first Soviet supersonic bomber.

New! >>> Online Book Club <<<



TO GIVE OUR READERS THE OPPORTUNITY to dig deeper into books about aviation and space, *Air & Space/Smithsonian* has started an online book club. The second selection is *The Eerie Silence: Renewing Our Search for Alien Intelligence* by Paul Davies. A physicist, cosmologist, and astrobiologist at Arizona State University, Davies has written a book that examines why it is taking so long to establish communications with other life forms in the universe. Those who would like to participate are encouraged to read the book in preparation for the online discussion on the *Air & Space* Web site in September. The book's author will be available to answer questions from readers. For more details, visit www.airspacemag.com/bookclub.

The Eerie Silence: Renewing Our Search for Alien Intelligence

by Paul Davies. Houghton Mifflin Harcourt, 2010. 288 pp., \$27.

SETI, THE SEARCH for extraterrestrial intelligence, began in 1960 when an astronomer by the name of Frank Drake pointed a radio telescope toward the stars and proceeded to hear...false alarms, interstellar static, and random noise. Beyond that: absolutely nothing. That has been the fate of the dozens of ever-more sophisticated sky searches in the 50 years since, a disappointing result that Paul Davies refers to as "the eerie silence."

In this exhaustively researched, clear, and intelligently written book, Davies sets out to explain that result, and to assess the prospects for success in the future. It would be an understatement to say that Davies covers the waterfront. He canvases all the usual explanations, and then some: the ETs are not actually out

there; they are, but aren't broadcasting; they are broadcasting, but not by radio; they started broadcasting but stopped; and so on, down a long list.

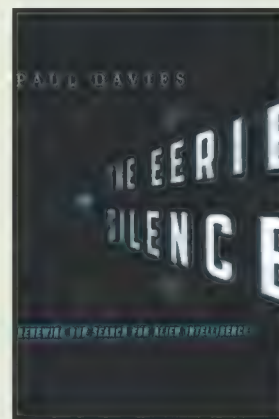
On the other hand, Davies also seriously considers some wilder possibilities: the ETs have already been here and left; they're here now, but are unwilling to reveal their presence; they've left artifacts or sentinels around, and all we have to do is find them. More speculatively still, ETs might exist in an exotic shape or form, such as a truly jumbo, hyper-intelligent quantum computer, whose intellectual concerns and modes of thought are so incommensurate with and different from our own that it would have no

reason for contacting us. "What could we possibly say to it?" he asks.

In the end, everything hinges on whether life and intelligence are rare in the universe, or abundant. Of the millions of species that have lived on Earth, technological intelligence has arisen only once, which means that it

is probably a rare commodity, even if life itself is widespread. But Davies believes that life is almost certainly not common. "We are probably the only intelligent beings in the universe," he concludes, "and I would not be very surprised if the

solar system contains the only life in the universe." An eerie silence indeed.



ED REGIS EDITED EXTRA-
TERRESTRIALS: SCIENCE AND ALIEN INTELLIGENCE (CAMBRIDGE PRESS, 1985).



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Reviews & Previews

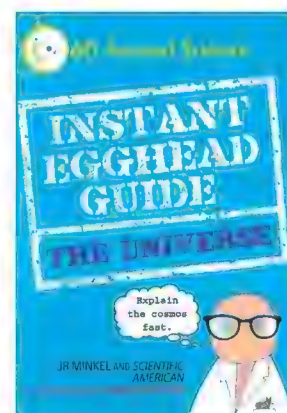
Instant Egghead Guide: The Universe

by J.R. Minkel and Scientific American. St Martin's Griffin, 2009. 221 pp., \$14.99.

THERE'S AN EXTENDED "Simpsons" couch gag in which after Homer, Marge, Bart, Lisa, and Maggie scramble to the couch, the camera rockets backward through the roof and shoots through a layer of clouds, out of the atmosphere, past the solar system, the Kuiper Belt, the Milky Way galaxy, and finally the universe, which turns out to be an atom in Homer's eye. (It's a sendup of the famous 1968 film *Powers of Ten*, directed by designers Charles and Ray Eames.) That's one way to think of this small paperback: a literary version of the Simpsons bit. In the *Instant Egghead Guide*, by J.R. Minkel and *Scientific American* (full disclosure: I contributed to *SciAm* for seven years or so), each spread covers a single topic, beginning with electrons, then moving toward ever-larger objects: atoms, elements, planets, and star clusters, etc.

Instant Egghead is like snack food for the mind: perfect for the subway, a little too involved for the traffic jam. Each spread cracks the topic into three sections: "The Basics," to describe exactly what the topic is; "On the Frontier," explaining what it all means; and "Cocktail Party Tidbits," a few bullet-pointed fun facts. The clever tidbits might impress someone at a party honoring the recipients of the next MacArthur Foundation "genius" grants. At a recent shindig, I said in passing, "Researchers have used big magnets to levitate live frogs, grasshoppers, hazelnuts, tulips, and other organisms," and...silence. But it was much more of a "The most abundant elements in the universe are hydrogen and helium" crowd.

PHIL SCOTT WROTE *HEMINGWAY'S HURRICANE* (MCGRAW HILL, 2006).



Heavenly Ambitions: America's Quest to Dominate Space.

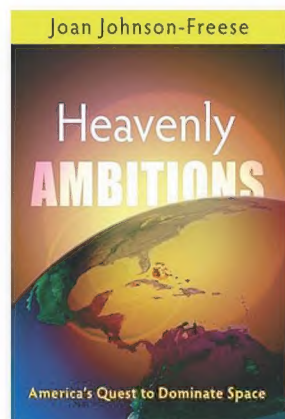
by Joan Johnson-Freese. University of Pennsylvania Press, 2009. 192 pp., \$29.95.

JOAN JOHNSON-FREESE'S *Heavenly Ambitions* invites us into a shadowed but vitally significant corner of American technological and political life: the national security uses of space. Since the earliest years of the cold war, space and its military exploitation have been inseparable in national thinking.

This is the background for *Heavenly Ambitions*. Johnson-Freese lays out the history of decisions, contending factions, and ideologies that have shaped national security policy in space, particularly since the beginning of the Reagan administration.

At the center of her account is a familiar conclusion: that the rise of a conservative ideology has sharpened the divide between two visions of how space might be used to serve American interests. The conservative stance argues that space is essential terrain (think of the vital role that satellites of all kinds play in daily life) and that the nation should actively maintain

control of this asset. The countervailing view is that in a global world, in which many other nations also have made space central to their ambitions, such a position is



untenable and counterproductive. American interests would be better served by strategies of cooperation and collaboration. Johnson-Freese, a professor at the Naval War College, argues for the latter position. Especially for those steeped in NASA history, this short volume is worth reading, if only as a reminder of the centrality of national security in U.S. space activities and the political passions it has excited.

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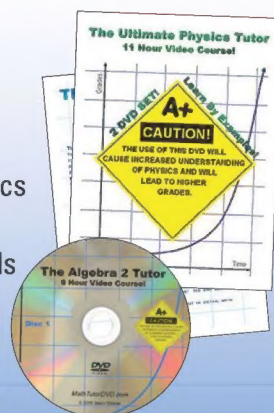
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A PREVIEW:



I'd Like to Report a Flying Saucer

In France, there's a number you can call.

Cause Unknown

The National Transportation Safety Board's toughest unsolved cases.

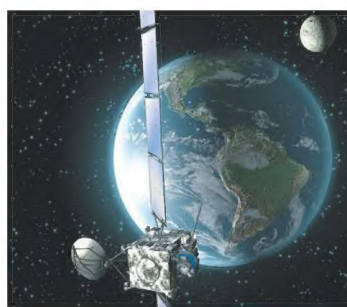


Curse of the Cargomaster

What caused the Douglas C-133 to crash nine times in as many years?

Cold Case

A team of search-and-rescue sleuths armed with the latest technology hunt for long-lost aircraft.



The Force Is With Them

Why do spacecraft hurtling past Earth sometimes speed up and sometimes slow down?

From left: The moon hangs in the night sky over Los Angeles, a Douglas C-133B Cargomaster, Europe's Rosetta spacecraft (artist's concept).

LEFT: DAVID M. JURASEVICH/MT WILSON OBSERVATORY; MIDDLE: MARK DUEHMIG; RIGHT: ESA/C. CARREAU

Credits

Cornwell's Folly. Lewis A. Bartlett is a man of great vision: He says it was so flat where he grew up, some Mondays he could see all the way to Wednesday.

How to Degauss a Cat. Cessna 182 owner G. Curtis Hoskins, now retired from his practice as a pathologist, writes about the natural silliness of the world.

The Truck. Paul Hoversten is the executive editor of *Air & Space/Smithsonian*.

The Drifters. A writer and former New York City cab driver, Mark Karpel drove the chase van for Jonathan Trappe's English Channel flight.

Flying Bombers in World War II. Melissa Jordan is a writer based in the Washington, D.C. area.

Monster Bomber. Mark Bennett worked at McDonnell Douglas/Boeing for 10 years as a graphic artist, then co-founded BDN Aerospace Marketing in 1999.

Build-It-Yourself Helicopters. James R. Chiles is the author of *The God Machine: From Boomerangs to Black Hawks, The Story of the Helicopter* (Bantam Dell, 2007).

Barnstorming in the Blood. Writer and airshow pilot Debbie Gary has enjoyed writing about the best in her profession in *Air & Space's* trilogy of features on airshow performers.

How to Win Enemies and Influence Policy. Mark Wolverton is the author of *A Life in Twilight: The Final Years of J. Robert Oppenheimer* (St. Martin's Press, 2008).

The Classic Wagon. John Fleischman is a frequent *Air & Space* contributor.

Don Parsons has been photographing antique and classic airplanes for 37 years.

Black Day at White Sands. Frequent contributor Preston Lerner most recently wrote about Arizona's Thunderbird Field, a World War II training complex, in the Feb./Mar. 2010 issue.

Fill 'er Up. Roger Mola is the *Air & Space* researcher.

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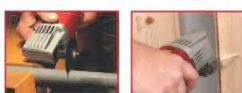
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Perfecting the People Filter

WHETHER IT'S CAUSE for celebration or regret, last month marked the 40th anniversary of the first U.S. airport-wide system to screen all departing passengers in an effort to prevent hijacking. On July 17, 1970, New Orleans International in Louisiana became the first airport to use magnetometers to detect weapons—or anything made of metal—together with behavioral profiling of passengers. For anyone flagged by the system, airline personnel formed the initial gauntlet, and U.S. Marshals Service staffers were called in to investigate unresolved questions.

The need for airport security systems had been gradually building from a more innocent time, when passengers and friends embraced at departure gates and families met loved ones as they stepped into the terminal. Except for isolated incidents involving explosives and insurance fraud, the first half-century of commercial air travel was comparatively tranquil. That changed on May 1, 1961, when a passenger on an airliner bound for Key West, Florida, forced the pilot to fly to a country that later became synonymous with hijacking: Cuba. Before the end of August, four more similar incidents occurred. No laws penalized such acts, and Congress hastened to criminalize “skyjacking,” the term the media coined for the practice.

In 1968, airlines started putting armed guards on flights, but it didn't help much; that was an especially bad

year, with 12 airliners and six private aircraft forced to detour to Havana. When eight airliners were hijacked to Cuba in the month of January 1969 alone, Florida became the air marshals' most prominent posting, and a federal task force met to devise some kind of plan. Organized under the Federal

profiling, and had magnetometers in place, at some of its terminal operations. The year 1969 ended with a total of 87 hijackings worldwide, 40 of those in the United States.

Magnetometers, more commonly known as metal detectors, were rumored to be compromised when

Glock, an Austrian maker of pistols, introduced an automatic with some plastic parts, but the gun was still 83 percent metal. To date, there has been no firearm manufactured that won't trip the venerable metal detector, and every airport in the United States serviced by a scheduled airline has some means of ensuring that passengers are weapon-free. Some groups challenge the concept of identifying possible perpetrators by certain characteristics, saying that law enforcement officials should use only one criterion for suspicion or detention of an individual: reasonable cause.

The Israeli air security system was—and still is—the world standard. Israel

may justify its approach by experience: In 1976, a Paris-bound Air France flight was hijacked from Athens, Greece, and flown to Entebbe, Uganda. Israel Defense Forces, on a night raid, freed 103 hostages and lost five fellow citizens. One was Jonathan Netanyahu, commander of the raid and the older brother of Benjamin Netanyahu, the current prime minister. Compared to that, prevention seems preferable.

■ ■ ■ GEORGE C. LARSON, MEMBER, NAA



Right of Passage: In contrast to the early days of commercial airline travel, today, airport security officers screen passengers and their carry-on baggage in an effort to prevent attacks.

Aviation Administration's Office of Aviation Medicine, the group drew on experiences from all over the world to come up with a profile of behavior common to hijackers. By October, Eastern Air Lines, whose bread and butter was its Florida routes, used